GLOBAL CONNECTIVTY REPORT 2022

CHAPTERS 7, 10. POLICY AND REGULATORY STRATEGIES THAT DRIVE DIGITAL TRANSFORMATION & MEASURING MEANINGFUL CONNECTIVITY: THE CASE FOR MORE AND BETTER STATISTICS

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DOI: 10.36724/2664-066X-2022-8-5-34-41

ABSTRACT

The Global Connectivity Report 2022 takes stock of the progress in digital connectivity over the past three decades. It provides a detailed assessment of the current state of connectivity and how close the world is to achieving universal and meaningful connectivity, using a unique analytical framework. It goes on to showcase solutions and good practices to accelerate progress. The second part of the report consists of seven thematic deep dives on infrastructure, affordability, financing, the pandemic, regulation, youth, and data. *Chapter 7* (Policy and regulatory strategies that drive digital transformation). The need to redefine policy priorities, the roles of stakeholders, and to identify new tools has never been more pressing. Tensions, nevertheless, persist between established and emerging approaches to policy and regulation and new strategies will need to prove themselves. As digital markets grow and move towards everything-as-a-service, an agile and iterative, lean approach to policy and regulation has started to develop. The agency of regulators and policy-makers and their agility will be the keys to making the implementation of digital policies more impactful. *Chapter 10* (Measuring meaningful connectivity: The case for more and better statistics). Data are vital to universal and meaningful digital connectivity. While data volumes have grown exponentially, for many countries reliable statistics on digital connectivity remain surprisingly scant. To assess progress, data on the deployment and uptake of digital technologies are essential. ITU collects, analyses and disseminates statistics from administrative sources and household surveys conducted by national statistical offices. While much progress has been made in recent years, large data gaps remain, especially on indicators collected from household surveys. These gaps are symptomatic of wider data gaps elsewhere. More and better data are needed to understand and remove the barriers to meaningful connectivity, especially for the marginalized people who are still offline. Data cultures, funding and improving the collection, processing and use of data are integral to development.

KEYWORDS: *ITU, digital transformation, Internet of Things (IoT),* Measuring meaningful connectivity.

INTRODUCTION

The need to identify new tools has never been more pressing. Five strategies are at hand for policy-makers and regulators to navigate the digital transformation and connect the unconnected.

1. Policy leadership is built around embracing ambiguity and uncertainty with a growth mindset and out-of-the-box thinking, so when new challenges emerge, policy-makers and regulators can combine the 'tried-and-tested' with a new approach, and with equal ease.

3. Building a common language across stakeholder groups is essential to avoid policy implementation getting lost in translation. Leveraging stakeholder dialogue and data to guide decisions will co-create more diverse and resilient regulatory solutions.

4. In the wake of recovery from COVID-19, governments have an opportunity to reframe their policy agendas and mainstream new priorities along with a broad development perspective.

5. The speed of learning provides a competitive edge in business and technology. Problem-solving is impossible without building new skills and competences, formulating strategic thinking around new issues in digital markets and implementing novel regulatory approaches. A focus on emerging skills is key to building adequate institutional capacity and preparing for current and future challenges.

Data are vital to universal and meaningful digital connectivity. While data volumes have grown exponentially, for many countries reliable statistics on digital connectivity remain surprisingly scant.

To assess progress, data on the deployment and uptake of digital technologies are essential.Many organizations, including ITU, are leveraging the potential of big data, particularly from mobile networks and open-source data from social media, crowdsourcing platforms, and online search engines. ITU has devised methodologies for using big data to complement traditional ICT statistics and has carried out pilot projects in several countries. Progress to date is promising, with guidelines prepared on how mobile phone data can be used to measure the information society [1-7].

Closing the data gaps is crucial for closing the digital divides and achieving universal connectivity. More and better data are needed to understand and remove the barriers to meaningful connectivity, especially for the marginalized people who are still offline [8-10]. Data cultures, funding and improving the collection, processing and use of data are integral to development.

POLICY AND REGULATORY STRATEGIES THAT DRIVE DIGITAL TRANSFORMATION

As digital technologies have become more widespread, affordable and powerful, policy and regulation have shifted focus from the narrow telecommunication sector to powering the digital transformation across the economy. The baseline for effective regulation has changed. Furthermore, new approaches offer multiple paths through the digital transformation. Such approaches rely on shorter and more inclusive policy cycles, agile regulatory responses and continuous experimentation, to match the pace of innovation and the ambition of the global development agenda. Unlike traditional telecommunication regulation, there is no single blueprint for best practice, but an array of tools that converge towards common goals that match the specificities of national contexts, political and legal systems, cultural backgrounds and economic priorities.

In the vortex of widespread change in the aftermath of COVID-19, the need to redefine policy priorities and the roles of stakeholders, and to identify new tools, has become more pressing. Tensions nevertheless persist between established and emerging approaches, so new strategies will need to prove themselves as old certainties may not hold true – and new norms are yet to form.

Below, will go on to explore five strategies that policy-makers and regulators can adopt to navigate the digital transformation, and deliver on the ambition and needs of both the connected and the unconnected. Each of these strategies broadens the policy options at hand, and avoids anchoring decisions in the past or using a silo perspective. They put decision-makers in the driver's seat through the digital transformation journey, and offer the keys to unlocking digital dividends for all. These strategies are grounded in the findings of the G5 Benchmark, a reference framework of good practices for digital policy and regulation.

Through a natural process of tension and disruption, the mainstream policy perspective has shifted towards more inclusive multistakeholder processes. These seek to meet both complementary and competing objectives of governments, businesses and citizens – from affordability and inclusion to sustainability and economic growth, to innovation and investment. National decision-makers need to pursue long-term market development, while remaining agile and retaining short-term flexibility and a 360-degree perspective. New leaders in policy and regulation need to master the blending of traditional and experimental approaches, combining styles of rule-making and enforcement – and adapting their implementation to local context and circumstance.

While traditional regulatory approaches remain prevalent, experimental techniques are emerging and are increasingly adopted. In the experimental space, several models have been gaining momentum:

• Sandb xing: Regulatory sandboxing promotes innovation and allows open, dynamic participation of stakeholders, while encouraging the adoption of new technologies and business models by industry and society. Today, nearly a quarter of countries worldwide have created safe spaces for regulatory experimentation – regulatory sandboxes. Rwanda stands out with its "test and learn" environment: companies can obtain a one-year permit allowing them to try new ideas, concepts and services within a light-touch regulatory framework. Rwanda's proof-of-concept hubs have enabled the development of transformative services and applications including drone-based and artificial intelligence (AI)-driven health services, such as Zipline. The performance-based approach allows both regulators and operators to respond

dynamically to technical challenges, including ensuring public safety. In Colombia, a regulatory sandbox designed by CRC, the communications regulator, has provided an alternative regulatory mechanism to test communication products and services for a limited period under flexible or no regulation. The first regulatory sandbox in 2020 piloted 23 different proposals, ranging from bringing 4G coverage in rural areas with new technologies to a platform for real-time measurement of the mobile Internet user experience, and a simplified contracting process for fixed and mobile services through a unified service agreement.

• Policy labs: In the United States, some state and local governments have established policy labs to partner with academia, using administrative data to evaluate and improve programmes and policies, while safeguarding personal privacy. The labs provide the technical infrastructure and governance mechanisms to help governments gain access to analytical talent, while the data labs are helping to convert data into insights, and driving more evidence-based policy-making and service delivery.

• High-level framework for experimentation: Almost a third of countries have identified emerging technologies as a policy priority adopting a forward-looking spectrum strategy or regulations and plans with regard to IoT. Far fewer have specifically tackled key new areas such as cloud computing or AI – respectively one-fifth and one-sixth of countries – with only 16 countries having integrated all of those complementary areas. In effect, the vast majority of governments have yet to canvas emerging technology issues in their policy and regulatory frameworks.

Demolishing silos is the way forward in modern governance – and yet, silos are still common in national institutions and policy implementation. Adopting a whole-of-ecosystem approach to policy inception, design, prototyping and implementation is an issue in many countries.

In the context of digital transformation, a single-sector perspective can no longer be the mainstay of a policy. The design of governance networks for digital – will be different from the previous generations of institutions, moving away from silo thinking and insular decision-making. New models of stakeholder collaboration and coordination will emerge from those that are more prevalent today, taking the breadth and depth of interaction to the next level. Collaboration will likely evolve towards patterns that are functional, blended into governance processes, and multi-modal. Outcome-based approaches will leverage fluid, needs-based collaboration, both formal and informal, as an essential feature of governance networks.

Traditional models of formal and informal collaboration at the national level have become mainstream across regions, and across different political and legal systems.

As the ICT regulator mandate has expanded into new areas, 60% of them collaborate beyond their traditional sector with ministries of education, health and government services. In this context, informal channels are used more often than among independent regulatory authorities, accounting for a quarter to a third of interactions between the ICT regulator and ministries [11-15]. After two years of the global pandemic, the case for a whole-of-government approach is clear. In 70% of countries, coordination and collaboration have increased between the ICT regulator and the national agency in charge of the digital transformation.

Building a common language across stakeholder groups is essential – this avoids policy implementation getting lost in translation in the context of digital transformation. Leveraging stakeholder dialogue and data to guide decisions will allow co-creating more diverse and resilient regulatory solutions.

Digital policies are increasingly underpinned by sustainability and innovation. The 2030 Agenda for Sustainable Development is an example of streamlined development imperatives and the goals cutting across the board. Mainstreaming core themes across digital and sectoral policies can make coordination on the ground smoother and allow faster progress towards higher-level development goals.

A sound regulatory roadmap will accompany national stakeholders in unfolding implementation and keeping on track. By providing clarity and predictability, a roadmap provides a single reference frame for implementation mirroring a high-level policy vision and operationalizing its objectives. A regulatory roadmap is a useful instrument for keeping everyone aligned to common objectives and in sync with other stakeholders. From stakeholder coordination to planning investment and deployment decisions to making sure efforts deliver desired outcomes, regulatory roadmaps provide a framework for ecosystem orchestration of policy implementation across the economy and society.

Slightly more than half of countries have digital strategies covering multiple economic sectors, leading the way to economic recovery. Examples of native digital agendas are the EU 2030 Policy Programme ‘Path to the Digital Decade’, the Kenya Digital Economy Blueprint and the Malaysia Digital Economy Blueprint. More than a third of countries also have defined mechanisms for implementation and operational objectives in their strategies. While these figures spell good news for millions of digital users in these markets, the majority of countries still need to define digital policy priorities and commit to sound implementation frameworks.

Regional digital agendas provide a much-needed framework for policy and regulatory harmonization – and help in putting digital transformation at the top of national policy agendas. The Digital Agenda for Europe and the Digital Transformation Strategy for Africa (2020–2030) are aligned with the Sustainable Development Goals of the 2030 Agenda 2030 goals and elevate national aspirations to the continental level. Leveraging cross-country political and implementation dynamics, and regional harmonization of digital agendas, also offer better chances of achieving the development objectives at hand sooner through economic integration. In 2017, Kenya held a ministerial conference on open data for agriculture and nutrition, where the Nairobi Declaration, a 16-article statement on open data policy in agriculture and nutrition, was signed by 15 African ministers. Francophone African countries have developed a similar network to support public policy development through CAFDO (Communauté Afrique Francophone des Données). Such

initiatives have the potential to unlock new entrepreneurship and development opportunities and their timely transposition into national law and systemic implementation can fast-track digital transformation of economies across the region.

Forward-looking national strategies in specific areas can complement holistic ones and support a more specialized development path – for example, leveraging AI or IoT integration across economic sectors, in smart cities, or robotics. As an example, Colombia's AI strategy aims to develop a dynamic and thriving AI market in Latin America, creating a laboratory for an AI market where designers, suppliers, intermediaries and consumers of this technology interact freely, facilitated by investment incentives to foreign and local entrepreneurs. The National Strategy on Blockchain by the Ministry of Electronics and Information Technology of India has the ambition to create trusted national blockchain infrastructure that can be used to experiment with digital solutions for development and made available across the economy, in sectors such as finance, research and development, and government services and education.

Moreover, monitoring and evaluation of government policies more generally lags in a vast majority of countries, blurring the blueprint of policy implementation, and failing to address new issues as they come up. In only one-third of countries, ministries or regulatory agencies conduct ex-post policy reviews; and still fewer, one in eight, conduct rolling policy reviews. Without systematic application of basic policy review instruments, keeping implementation on track becomes a challenge, and accountability suffers, to the detriment of users suffering digital divides.

Beyond the national level, Canada, Denmark, Italy, Singapore, Japan, the United Arab Emirates and the United Kingdom have launched an intergovernmental regulatory collaboration network. Called "Agile Nations", whose core mission is to help innovators navigate the complex regulatory landscape, test new ideas in collaboration with regulators, and scale their innovation across digital and other emerging markets – all while upholding protections for citizens and the environment. At the global level, the United Nations Secretary-General has laid out a Digital Cooperation Roadmap, in which all stakeholders play a role in advancing a safer, more equitable digital world – one that will lead to a brighter and more prosperous future for all. The roadmap is co-implemented by United Nations organizations, governments and the international multistakeholder community.

In the "new normal", the speed of learning provides a competitive edge in business and technology. Problem-solving is impossible without building new skills and competencies, formulating strategic thinking around new issues in digital markets and implementing novel regulatory approaches.

Continuously upskilling people generates growth in the advisory role of ICT regulators into other sectors going through digitalization, and to citizens – while casting a wider net through initiatives such as innovation labs that help start-ups grow and work together, through digital mentorship schemes and communities of practice and research programmes.

Digital transformation is a once-in-a-generation opportunity to leverage digital technologies and Internet access as an equalizer of global development, providing every country and individual with access to new economic and social opportunities. The current state of digital markets at the global level has not connected everyone everywhere, and new approaches are needed to make the digital economy more inclusive.

New lean patterns of digital policy and regulation will provide a canvas for problem-solving in the context of digital transformation, powering virtuous cycles across ecosystems, and fast-tracking the achievement of social, economic and environmental goals towards the Future We Want for all.

MEASURING MEANINGFUL CONNECTIVITY: THE CASE FOR MORE AND BETTER STATISTICS

Data are vital for achieving universal and meaningful digital connectivity. Data help us understand our world. They tell us where we were, where we are, what works and what does not. They are a key element in empirical research for identifying trends, patterns and good practices. Data help policy-makers design better, more targeted and more effective policy interventions.

Many societies are witnessing a newfound appreciation for data and what they can do for us. As we go about our lives, we leave data traces everywhere. Data volumes have grown exponentially. The deployment of 5G broadband is already under way, with talk of 6G now begun. The impact of these new technologies will be transformative – and will generate more new data flowing across many additional connected devices [16-20]. Lower storage and processing costs have in turn led to hugely increased analytical power. Appropriately harnessed, such data will help alleviate data poverty, particularly in the information and communication technology (ICT) context.

However – and somewhat paradoxically – for many countries, reliable statistics in key areas, including digital connectivity, remain surprisingly scant. While raw data are abundant in the ICT domain, a lot of them are privately owned and inaccessible to many countries. Collecting survey data and transforming them into actionable insights require advanced skills and significant resources, which many countries lack. This chapter makes the case for more and better data. It discusses approaches to data gathering, flags data gaps, highlights the need for more data literacy and governance, and concludes by setting out promising solutions to measuring digital connectivity.

Despite years of warnings that a new, dangerous virus was highly likely, countries worldwide were caught unprepared: the COVID-19 pandemic disrupted lives and societies worldwide. The pandemic brought to the fore the essential role of statistics in decision-making, and they were soon dubbed "the currency of our times" and "the new fuel". Data – and the statistics derived from them – have always been critical in solving problems, indispensable in running businesses, and central to addressing issues such as universal education and disease eradication.

Raw data and analytical insights are indispensable, both for long-term strategic decisions and real-time responses in fast-moving situations where clarity is absent. ICT data became essential in governments' responses to curb the pandemic, particularly on matters of digital connectivity at the household level. Do the conditions for telework, telehealth and distance education exist? Where, for how many, and who will be left out?

National ICT statistics are a valuable asset. Earlier chapters highlighted how countries access and use ICTs in different ways.

To assess progress, we need data on the deployment and uptake of digital technologies. ITU, the United Nations specialized agency for ICTs, collects, analyses and disseminates (a) administrative ICT indicators, gathered annually from national telecommunication regulators; and (b) ICT household indicators collected from national statistical offices (NSOs).

National legislation that requires telecommunication operators to report ICT indicators (number of subscriptions and network coverage, etc.) directly to regulators results in good coverage of administrative ICT indicators.

ICT indicators on access and use by households and individuals come from household surveys conducted by NSOs. ICT household surveys are conducted on a needs-only basis. In many countries, NSOs do not have the financial and human resources to conduct ICT household surveys on an annual – or even semi-annual – basis.

This results in poorer quality insight into the extent of ICT access, use and skills within the population. While much progress has been made in recent years, large data gaps and blind spots remain – for example, on basics like numbers of connected households and Internet use.

Household surveys help assess how ICTs impact people's lives, providing insights into how people use ICTs.

Periodic household surveys with quality standards are large-scale and resource-intensive undertakings. They require careful planning, and take time – and are therefore costly. A 2017 World Bank study estimated the average cost at USD 170 per household, with much higher costs in sub-Saharan Africa. Many countries simply lack the capacity to collect, process and analyse the data. The availability of such resources is frequently beyond the reach of many developing countries, with resulting data gaps in ICTs.

Table 1 shows the availability of selected indicators in all economies, by ITU region. Indicators derived from administrative sources, such as fixed and mobile broadband subscriptions, have good coverage across most regions. In contrast, indicators derived from household surveys, such as the share of individuals using the Internet or a mobile phone rarely, are sketchily represented (53% and 27%, respectively, for all economies).

The gap deepens for more granular statistics, such as Internet access among households living in urban or rural locations or Internet use by gender. These gaps in ICT statistics are symptomatic of wider data gaps elsewhere.

Table 1

Percentage of economies with available data, selected indicators (latest year 2018-2021)

	Fixed broadband/ 100 inhabitants	Mobile broadband/ 100 inhabitants	Mobile phone use, %	Internet use, %		Internet access, %	
				All	By gender	All	By urban/ rural
Africa	75.0	72.7	13.6	20.5	22.7	40.9	15.9
Americas	68.6	65.7	31.4	57.1	37.1	60.0	37.1
Arab States	90.5	90.5	38.1	52.4	52.4	52.4	23.8
Asia and the Pacific	70.0	67.5	22.5	42.5	40.0	50.0	17.5
Commonwealth of Independent States	66.7	66.7	44.4	66.7	66.7	88.9	66.7
Europe	95.7	95.7	28.3	87.0	87.0	87.0	58.7
World	79.1	77.6	26.5	53.1	49.5	60.7	33.7

Notes: Data availability weighted by population size is generally higher than as shown in the table. Economies reporting on fixed and mobile broadband represent more than 90% of the world's population. Economies reporting on Internet use and access represent 80 and 66%, respectively.
Source: ITU

Unequal development has disadvantaged lower-income countries, which lack the infrastructure, financial resources and skills necessary to produce data and subsequently extract value from them. They often lack adequate institutional, policy and regulatory frameworks that enable trust in environments conducive to statistics.

If a standalone ICT household survey is not feasible, one alternative is simply to insert key ICT questions into an existing survey. Labour force surveys have been useful, since they exist in most countries and are typically conducted sub-annually, with adequate samples for population coverage. Some countries, such as Mexico and Ghana, have also included questions on Internet access and use in their national censuses.

In parallel, data-gathering efforts by non-governmental organizations (NGOs) contribute to addressing the data gaps. Research ICT Africa has conducted household ICT surveys in several countries for years. The surveys, now entitled "After Access", examine connectivity in households and individuals, and shed light on numerous aspects of digital inequality. Similar surveys were also conducted by LirneAsia in Asia and by the DIRSI (Spanish acronym for Regional Dialogue on the Information Society) in Latin America and the Caribbean.

New solutions have enormous potential in addressing data poverty. ICTs can record astonishing amounts of information. From network infrastructure to service provider gear and end-user access devices, every exchange is recorded and every click is captured – creating an environment teeming with data. Understanding how digital technologies generate data is helping to create new approaches to exploit this potential.

The concept of "big data" has attracted much attention in recent years. Driven by the masses of data harvested by technology companies, it has sparked interest in research on a range of subjects that arise from the timeliness and sheer volume of such data.

Other sources are generating big data, too – satellite images, images from still and video cameras, sensors of all kinds, and more. In addition, vast amounts of data are produced from the telecommunication networks themselves.

The latter are more relevant for ICT statistics. ITU is exploring the potential of big data, particularly from mobile-cellular networks. Since 2016, pilot projects with eight countries have developed methodologies and explored how these new data sources might serve to (a) replace or improve disaggregation of current indicators; (b) propose new indicators that would increase the measurement opportunities for ICT; and (c) fill in data gaps.

Progress to date is promising, and is set out in a detailed guide that documents methodologies and standards on using mobile phone data for statistical applications. The success of these efforts requires the cooperation of mobile-cellular operators and Internet service providers. It also requires careful attention to legal matters concerning confidentiality and privacy. Within the United Nations system, ITU plays an active role in harnessing big data for official statistics, notably for the purpose of measuring progress towards the Sustainable Development Goals (SDGs).

ITU helped define guiding principles to maintain public trust when such data are used for public purposes – aligned with the United Nations' Fundamental Principles of Official Statistics. Mobile telephony technology generates large amounts of information that can be tapped. Mobile antennas have unique IDs and geolocation coordinates that allow for granular data by low geographical areas of coverage. Network log records contain domestic subscriptions for inbound and outbound roaming, and call detail records produced by telephone exchanges capture metadata, such as the time and duration of any transaction (Coordinated Universal Time (UTC) timestamp), whether a voice call, text, Short Message Service (SMS) or Internet access.

In addition to ICT indicators, the unique IDs of subscriber identity module (SIM) cards used in mobile-cellular networks have a relevance well beyond ICT statistics – extending, for example, to statistics related to internal mobility and commuting, tourism, infrastructure assets and migration. During the COVID-19 pandemic, many governments worked with mobile phone operators to track the mobility of its citizens to evaluate the effectiveness of lockdown policies or to predict the spread of COVID-19 to inform disease prevention strategies data.

Open-source data can help check the quality and reliability of ICT indicators provided by network operators. Some crowdsourcing tools, for example, can expose access inequality, since they measure signal strength, including dead zones, in what are sometimes reported to be areas with high broadband coverage.

For example, OpenCelliD is the world's largest collaborative community project collecting Global Positioning System (GPS) positions of cell towers. Its database covers millions of cell locations across the globe. WorldPop – an international collaborative project between academia, international organizations, national governments, private foundations and NGOs – is aimed at increasing the resolution of population projections to grid-level data. The project provides gridded population estimates at 1-kilometre and 100-metre grids. Mapping cell tower location with high-resolution population density maps can reveal populated areas that have limited coverage.

Figure 1 shows an example from central Nigeria, where the green areas represent population density and the circles represent cell towers. In rural areas, cell towers mainly follow the main roads, leaving large areas without coverage.

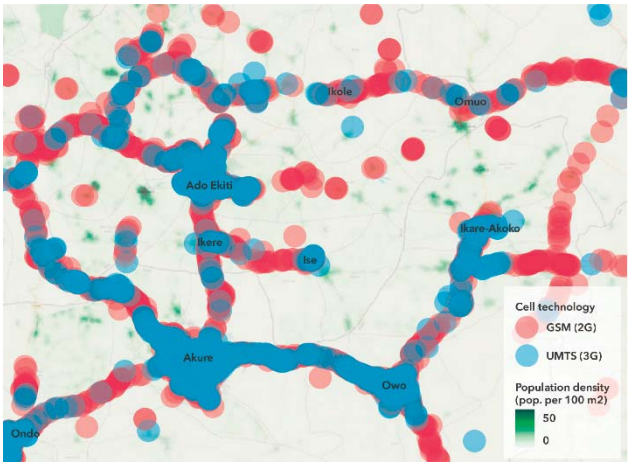

Figure 1. Population density map of Central Nigeria overlaid with location of cell towers

Sources: Data on cell locations are extracted from OpenCelliD (https://opencellid.org) on 28 November 2021. Data on population density are estimates for 2020 extracted from WorldPop (https://www.worldpop.org) on 11 April 2022

Speed tests can be used to check in geographical levels down to census blocks, and ascertain if broadband signals meet stated thresholds. Ookla is another example of a private company that repurposes its own data to provide a global index for Internet speeds, ranking countries for their fixed and mobile broadband. The Speedtest Global Index compares Internet speed data from hundreds of millions of tests every month around the world. Data on Internet speed can help in making decisions on broadband investments under consideration by governments or others. They can also support decision-making and first responders in emergencies by getting a better understanding of the type, level and quality of network connectivity after a disaster.

Other promising examples come from data made available by social media companies, crowdsourcing platforms and online search engines.

Disruptions in Tonga's telecommunication networks (Figure 2). Many accumulated data are held by private companies, generated by mobile phones, retail store scanners, satellites, even sensors connected to the Internet of Things with 5G networks. Initially, these data were essentially used to support companies' business models and operations. Now they are increasingly used for socio-economic research. Growing numbers of companies are making some data assets available as part of "data for good" or "data philanthropy" initiatives.

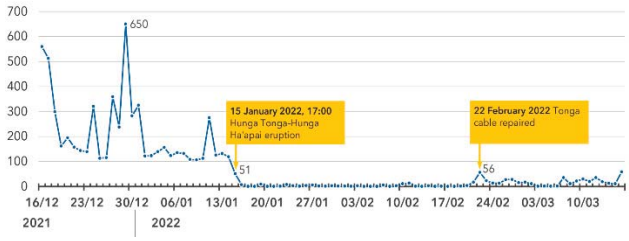

Figure 2. Data points per day from Speedchecker, Tonga, 16 December 2021 – 16 March 2022

Source: Speedchecker

At the same time, there is increasing recognition that access to such data needs to be governed by new codes of conduct – that regulation is needed to guide their use while protecting privacy and confidentiality. Undoubtedly, this area will see continuous evolution.

Partnerships and data-sharing agreements between the private sector and statistical agencies hold great potential in improving the accuracy, timeliness and granularity of official statistics. For example, combining data from telecommunication operators and Internet service providers with a country's population or household registers would generate indicators with an unprecedented level of granularity. Given that mobile penetration is at high levels in most countries, connectivity indicators could be produced for households, individuals and specific groups (older persons, minorities, persons with disabilities).

A recent European Union report makes a strong case for the sharing of private business data to reduce information gaps, stating the need "to explore the creation of an enabling environment for privately held data to be shared with (or at least be accessible to) public authorities in complying with their public-interest missions". Data access among different holders might require new legislation – and a new culture favouring collaboration [21-24].

Artificial intelligence and machine learning methods also have the potential to help estimate Internet access and use at the subnational level, based on satellite and other available data sources. These projects could contribute to a better understanding of Internet connectivity in countries where no reliable data exist [25-26]. Artificial intelligence and machine learning models could also complement traditional household surveys by using real-time data to "now-cast" connectivity indicators between surveys.

In the new era of measuring household connectivity, household surveys are no longer the exclusive means of gathering data. Alternative sources offer potential, but trade-offs between what is needed and what is available may not always be palatable. Commercial, privacy and resource limitations may hamper access to the level of granularity and quality needed to derive reliable ICT indicators.

The ability of countries to collect, analyse and extract value from data and realize their potential for public good depends on the presence and quality of a myriad of factors that make up the data ecosystem.

Recent changes in the world of data are challenging traditional statistical ecosystems. "Statistics Acts" may need to be updated in harnessing the potential of big data – for example, by encouraging collaboration between statistical authorities and private stakeholders, or facilitating data exchanges. Additionally, data fit for development purposes require a legal framework for governance that includes both safeguards and enablers.

The notion of statistical capacity-building is broad in nature and multi-faceted. It includes cooperation among institutions in a national statistical system, adequate infrastructure and evolving organizational capability. For example, human capital investments include retention policies for statisticians, analysts and data scientists; the development of technical skills in data collection, processing, integration and interpretation; and softer skills for the promotion of data use. Targeted subject matter training is also needed, e.g. on ICT statistics. Training and resources also need to extend to researchers who will make further use of data and generate real value from them.

Making progress on data poverty requires data infrastructure and connectivity. More investment is needed in backbone connectivity, Internet exchange points and data centres, to develop the capacity of developing countries to produce and use data. Cloud computing can partly compensate – easing the set-up of statistical infrastructure, providing ready access to modern tools and removing barriers linked to information technology staff shortages.

The high-level challenge before us is to foster data cultures that promote data literacy in our societies. This gradual process is ongoing everywhere, and will contribute to the understanding of the newfound prominence of data among the population at large. The aim is not for citizens to become statistical experts, but to build both an appreciation of – and trust in – quantitative information. At a time when misinformation and disinformation menace stability, strengthening the numeracy and critical capacity of the public is important.

CONCLUSIONS

Closing the data gaps is crucial for closing the digital divides and achieving universal connectivity. More and better data are needed to understand and remove the barriers to meaningful connectivity, especially for the marginalized and harder-to-reach populations who are still offline. The value represented in the use of data is garnering greater recognition – the insights and knowledge, which can then be incorporated in decision-making. The totality of work on data – from the conceptualization of a household ICT survey to its deployment, processing, analysis and dissemination – helps drive capacity building and subject matter training.

While international organizations have a role to play, adequate funding, priority setting and national strategies are needed. Broad-based social contracts for data help build trust and support innovation. For now, we must translate the lack of data as a call for action to remedy this lack. In the final analysis, data and data cultures are not elements outside of development. On the contrary, they are integral to it. Funding and improving the collection, processing and use of data are indeed development.

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ADVISORY BOARD ANNOUNCED FOR GEO WEEK 2023

Geo Week Advisory Board set to help craft programming, recommend speakers, and deliver critical insights to geospatial and built world professionals

Organizers of Geo Week, the premier event that champions the coming together of geospatial technologies and the built world, have announced an impressive list of influential leaders within the geospatial and built world industries who will be participating on the 2023 event's Advisory Board.

The 2023 event will take place February 13-15, 2023 in Denver, Colorado.