

A WORLD THAT COUNTS – MOBILISING THE DATA REVOLUTION FOR SUSTAINABLE DEVELOPMENT

1. A data revolution for sustainable development

1.1 What is the data revolution?

Data are the lifeblood of decision-making, and the raw material for accountability. Without data, we cannot know how many people are born and die; how many men and women still live in poverty; how many children need educating, and how many teachers to train or schools to build; the prevalence and incidence of diseases; if water is polluted or if the fish stocks in the ocean are dangerously low; how many adolescent girls are getting pregnant and what policies are effective in helping them; what companies are trading and whether demand for their product is expanding.

To know what we need to know involves a deliberate and systematic effort of finding out. It means seeking out high quality information that can be compared over time, between and within countries, and continuing to do so, year after year. It means careful planning, spending money on technical expertise, robust systems, and ever changing technologies. It means building public trust in the data, and expanding people's ability to use it.

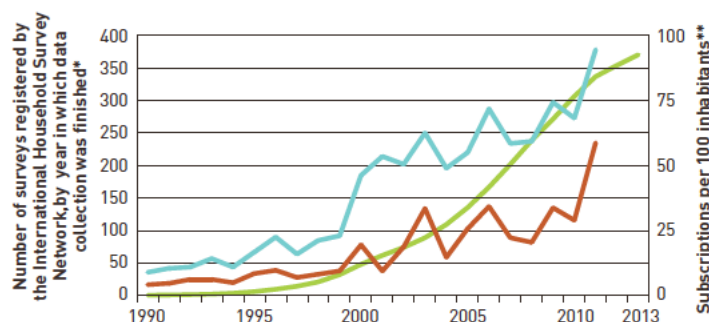
Since 2000, the effort involved in monitoring the Millennium Development Goals (MDGs) has spurred increased investment in just these things, to improve data for monitoring and accountability. As a result, we know much more now about the state of the world and, particularly, the poorest people in it. But despite this significant progress, huge data and knowledge gaps remain about some of the biggest challenges we face, and these gaps limits governments' ability to act and to communicate honestly with the public. Months into the Ebola outbreak, for example, it was still hard to know how many people had died, or where.

And now the stakes are rising. In 2015, the world will embark on an even more ambitious initiative, a new development agenda underpinned by the Sustainable Development Goals (SDGs). Achieving these goals will require integrated action on social, environmental and economic challenges, with a focus on being inclusive and thus ensuring that no one is left behind. This in turn will require another significant increase in the information that is available to governments, civil society, companies and international organisations to plan, monitor and be held accountable for their actions.

Fortunately, this challenge has come together with a huge opportunity. The volume of data in the world is increasing exponentially: one estimate has it that 90% of the data in the world has been created in the last two years¹. As the graph below demonstrates, the volume of both existing sources of data (represented in the graph by the number of household surveys conducted) and new sources (represented by mobile subscriptions per 100 people) have been rising, as has the openness of data (illustrated by the number of surveys placed on line). Thanks to new technologies, the volume, level of detail, and speed of data available on societies, the economy and the environment is without precedent. Governments, companies, researchers and citizens groups are in a ferment of experimentation, innovation and adaptation to the new world of data. This is the data revolution.

THE GROWTH OF DATA: TRENDS IN DATA AVAILABILITY, DATA OPENNESS AND MOBILE PHONE USE

— All Surveys
— Open Access Surveys
— Mobile-cellular
subscriptions
(per 100 inhabitants)



Source: * International Household Survey Network (<http://catalog.ihns.org/index.php/catalog>). For a detailed analysis of global trends in Survey data availability, see, e.g., Demombynes and Sandefur (2014), "Costing a Data Revolution." Center for Global Development, Working Paper 383.

** World Bank (<http://data.worldbank.org/indicator/IT.CEL.SETS.P2>), based on data from the International Telecommunication Union (ITU), World Telecommunication/ICT Indicators database

1.2 What is this report about and who is it for?

Revolutions do not begin with reports, and the data revolution is no different. This report is not about how to create a data revolution – it is already happening – but how to mobilise it for sustainable development. It is an urgent call for action now to support the aspiration for sustainable development and avert major social and environmental disasters, to stop and reverse growing information inequalities, and to ensure that the promise of the data revolution is realised for all.

In this first section we first describe what the data revolution is, and the opportunities and pitfalls it presents. The second section highlights the current state of data, and the kind of world we could see if the promise of the revolution is realised. Finally, the third section provides a “vision” of a possible world of data in 2030, and some recommendations for how to achieve it.

This report has been prepared in response to a request by the Secretary-General of the United Nations. We hope it will also be helpful to Member States, the UN System as a whole, and to the large constituencies that support the three pillars of the UN: peace, human rights and development.

We believe that governments, and governments acting together through the UN, have a crucial role to play. This report offers a way forward, framing the scope of the actions to be undertaken, showing how resources, actors, forms of collaboration and institutions can evolve, best be managed and deployed to make the data revolution a force for progress and for enhancing possibilities. It is about seizing the opportunity of the post-2015 development agenda and using the data revolution not only to monitor progress towards SDGs, but also to accelerate their achievement.

1.3 A revolution for what?

Example Box:

This is the revolution:

As part of a project to engage young people in disaster risk reduction, teenagers in Rio de Janeiro have used cameras attached to kites to gather aerial images, helping to identify the presence or absence of drainage systems, the availability of sanitation facilities, and impediments to evacuation. In Rio, this has already led to the removal of piled-up garbage and the repair of a bridge.

Source: UNICEFⁱⁱ

End box

The data revolution is **a revolution of possibilities** – of new technologies, data production and dissemination systems and new resources opening up to produce more and better data, as well as expanding what can be done with data. First and foremost, it offers the possibility of increased knowledge through data integration – the deliberate putting together of traditional and new data in ways which illuminate as yet unquantified aspects of human and planetary behaviour and allow for a more timely, nuanced, responsive and effective type of decision making.

This involves new sources of data – satellite imagery, social media or anonymous mobile phone records, or data created and willingly shared by citizens to monitor and reflect their own circumstances and priorities. It involves the quantification of what was previously considered qualitative data – for instance, defining proxies for the measurement of happiness or the fulfilment of human rights. Bringing together established and new sources in the service of sustainable development can shed new light on old problems, reveal new possibilities for action, identify what remains to be done and provide the real time monitoring that allow policies to be adapted for maximum effect. To fulfil this promise, it must be done in a way that adheres to the highest standards of honesty, respect of privacy, rigour and impartiality that have been developed over decades and centuries of academic research, statistical practice and political negotiation.

It is also **a revolution of expectations** – of people demanding that these changes and innovations be used to enhance their control over their own lives and the decisions that affect them. Data is the bedrock of accountability. More information opens up the possibility for an honest, informed dialogue between service providers and beneficiaries, between tax payers and governments who spend tax revenues, between companies and employees and between the private sector, governments and civil society. Data is the basis for social compacts and ultimately this contributes to improving the responsiveness, efficiency and effectiveness of institutions, and, eventually, the overall welfare of citizens.

But the data revolution comes with a range of **new risks**, posing questions and difficult challenges concerning the rights to access and use data. Fundamental issues of human rights: privacy, respect for minorities or data sovereignty requires us to balance the rights of individuals with the benefits of the collective. As more is known about people and the environment, so there is a correspondingly greater risk that the information could be used to harm, rather than to help. They could be harmed deliberately, if the huge amount that can be known about people's movements, their likes and dislikes, their social interactions and relationships is used with malicious intent, such as discriminating in access to services. Or they could be harmed inadvertently, if information that has not been checked for quality or standardised in accepted ways is used for policy or decision making and turns out to be wrong.

Without deliberate actions, the opportunities will be slower in coming and more unequally distributed when they arrive, and the risks will be greater.

The data revolution has huge potential to serve the sustainable development agenda: to empower citizens and to provide governments, companies and civil society with the information they need to achieve the SDGs. But at the moment it is only potential. Without fast and decisive action to shape this new world of data for the public good, not only will that potential not be realised, but inequalities will widen and citizens could see their rights eroded.

Change is happening. **The more slowly governments, companies, non-governmental organisations and individuals respond to the revolution out there, the harder and more expensive it will be to catch up.** Those with access to data and information will have more power in the new world than those who do not. The public sector is falling far behind the private sector in how they generate and use data to make decisions and monitor their impact. A lack of oversight and regulation in many places has created an information free-for-all, where information is available to track and monitor individual actions, but citizens have little democratic control over how it is used, stored and shared, and where the creators of data are under no obligation to share it, or to present it in ways that serve the public good. At the same time, privacy regulations elsewhere are growing ever more restrictive in response to concerns over misuse of data without creating space for innovation in reusing data in ways that promote accountability and serve the public good. Value creation and appropriation emanating from information is not always managed for the good of the public and people and governments in richer countries have more possibilities than those in poorer countries to get access to, knowledge of, and capacity to use and benefit from the new information opportunities that the data revolution has created.

Above all, this should be a revolution for equity in access and use data.

Major gaps are already opening up between the information haves and have-nots. Without action, a whole new inequality frontier will open up, splitting the world between those who know, and those who do not.

Many people are excluded from the new world of information by language, poverty, lack of education, remoteness or prejudice and discrimination. While the use of new technologies has exploded everywhere in the last ten years, the costs are still prohibitive for many. In Nicaragua, Bolivia and Honduras, for example, the cost of a mobile broadband subscription exceeds 10% of average monthly GDP per capita, compared to France and Korea where it is less than 0.1%ⁱⁱⁱ. The information society should not force a choice between food and knowledge.

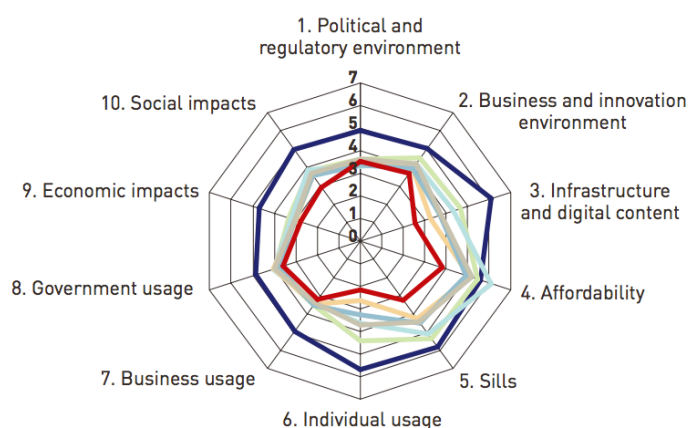
In several countries, the public sector is not keeping up with companies which are increasingly able to collect, analyse and respond to real-time information as quickly as it is generated. Although it is getting faster, in many countries the reporting of GDP figures is still months behind real activity, while companies are able to monitor their output, employment, and sales in real time.

Richer countries are benefitting more from the new possibilities than poorer countries that lack the resources for investment, training and experimentation. According to McKinsey, African countries spend about 1.1% of GDP on investment in and use of internet services, less than a third of what, on average, is spent by richer countries – meaning that the gap in internet availability and use is growing every year, as some regions accelerate ahead^{iv}. The graph below shows how advanced economies are ahead of the rest of the world on every indicator of access to, use of, and impact of the use of digital technologies.

If our vision is of a world where information reduces rather than increases inequalities, we are still a long way from realising that ambition.

INEQUALITIES IN ACCESS TO AND USE OF ICT SERVICES*

- Advanced economies
- Southern, Central and Eastern European Countries
- Commonwealth of Independent States and Mongolia
- Developing Asia
- Latin America and the Caribbean
- Middle East and North Africa
- Sub-Saharan Africa



* Regional averages based on The Global Information Technology Report 2014, by the World Economic Forum

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158 **If there are gaps in the mobilisation of new opportunities for the public interest, it is up to**
 159 **governments to fill those gaps, working together in the multilateral system, at regional and**
 160 **global levels.** It is governments ideally working in collaboration with forward looking and socially
 161 responsible private institutions, who can set legal frameworks to guarantee data privacy and
 162 security of data for individuals, and ensure its quality and independence. It is governments who
 163 can balance public and private interests and create systems that foster incentives without creating
 164 unacceptable inequalities, adopt frameworks for safe and responsible use and manage the
 165 international system that can transfer finance and technical expertise to bring the least informed
 166 people and institutions up to the level of the most informed. And it is governments who are
 167 elected to respond to citizens on their choices and priorities.

168 New institutions, new actors, new ideas and new partnerships are needed, and all have something to offer
 169 the revolution. But national statistical offices, the traditional guardians of public data for the public
 170 good, will remain central to government efforts to harness the data revolution for sustainable
 171 development. To fill this role, however, they will need to change, and more quickly than in the past, and
 172 continue to adapt, abandoning expensive and cumbersome production processes, incorporating new data
 173 sources, and focusing on providing data that is human and machine-readable, compatible with geospatial
 174 information systems and available quickly enough to ensure that the data cycle matches the decision cycle.
 175 **In many cases, technical and financial investments will be needed to enable those changes to happen.**

176 Example Box

177 This is the revolution

178 The GEO Global Agricultural Monitoring initiative uses weather and satellite data, data from
 179 regional bodies and from national governments to provide monthly reports on the growing
 180 conditions for four major crops (maize, rice, soybeans and wheat) that between them account for
 181 70% of the calories consumed by humans worldwide. Within only a few years, daily satellite
 182 imagery will be available^v.

183 End box

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186 **Box**

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188 **New data, health services and malaria**

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190 Malaria is one of the biggest killers in several developing countries and imposes a huge strain on
191 health systems. Using new data sources to inform planning and policy can improve services and
192 reduce deaths.

193 The Mtrac programme in Uganda, supported by UNICEF and the WHO, uses SMS surveys completed
194 by health workers to alert public health officials to outbreaks of malaria, and lets them know how
195 much medicine is on hand at health facilities, so they can anticipate and resolve any shortages.

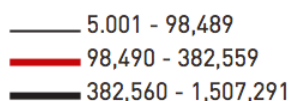
196 Before Mtrac, the Ministry of Health had very little health facility-level data, either paper or
197 electronic. By March 2014, that's to this programme, 1,203 district health officials, 18,690 health
198 facility workers, and 7,381 village health team workers were using the system. Now the Ugandan
199 government is collecting data from thousands of health facilities, capturing and analysing results
200 within 48 hours at a total cost of less than US\$150 per poll. The Anonymous Hotline receives an
201 average of 362 actionable reports per month, and approximately 70% of these reports are
202 successfully followed up at the district level within 2 weeks. The number of facilities that were out
203 of stock of Artemisinin-based Combination Therapies (ACTs) to treat malaria at any given time had
204 fallen from 80% to 15%.

205 In the longer term, new sources of data might also have a role in tracking and predicting
206 epidemics of malaria or other diseases. Combining strongly anonymized data from the Orange
207 mobile telephone network on movement patterns and their geographic relationships within
208 population with official information from the WHO on the spread of malaria, the University of
209 Minnesota School of Public Health produced epidemiological models that are more detailed
210 than any currently in use. This knowledge could be used to create services to notify doctors,
211 field hospitals and the general public ahead of epidemics, using mobile networks or local
212 radio. Similar work has been done on the spread of AIDS, cholera and meningitis, and could
213 be used for rapid response and planning for new epidemics.

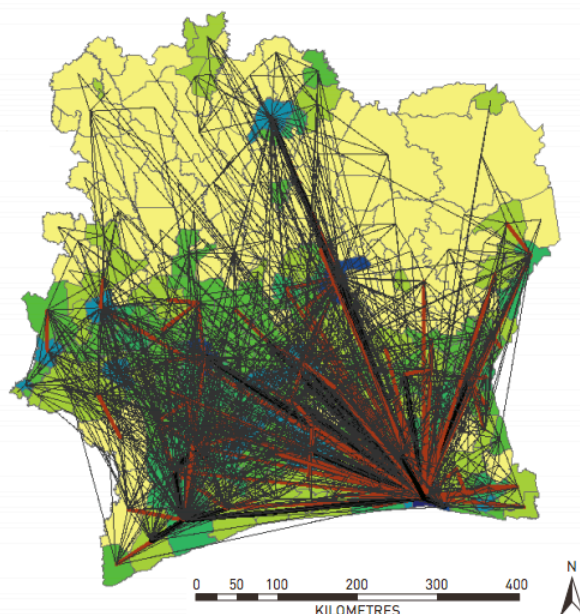
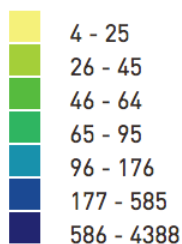
214 Source for graphics: de Cordes, Nicolas, The use of big data for development goals, DEF
215 Yearbook 2014 – “Social Networks and Social Machines, Surveillance and Empowerment, to appear in November
216 2014 (<http://www.digitalenlightenment.org/publication/def-yearbook-2014>)

POPULATION DENSITY AND COMMUNICATION BY SUB-PREFECTURE

Number of calls between sub-prefectures

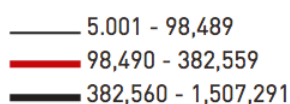


Population density per sq Km



MALARIA PREVALENCE AND COMMUNICATION BY SUB-PREFECTURE

Number of calls between sub-prefectures



Population density per sq Km

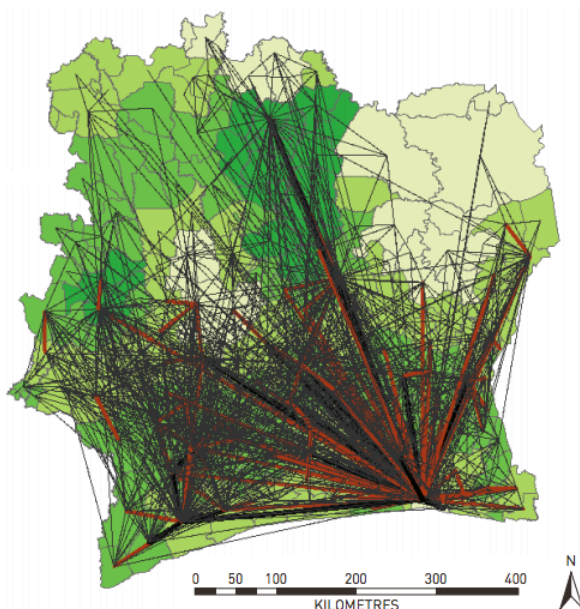
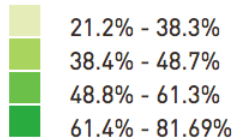


Figure 2:

Communication patterns of mobile phone users in Côte d'Ivoire between sub-prefectures are shown, weighted by the number of calls that were made between December 2010 and April 2011, superimposed on (a) the 1998 population density and (b) the prevalence of malaria, as estimated by Raso et al. [25]. For clarity, only edges representing more than 5,000 calls over the 5-month observational period are shown.

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219 **End box**

2. The data revolution for sustainable development

In September 2015, the UN Member States will commit to an ambitious new set of global goals for a new era of sustainable development. Achieving this will require an unprecedented joint effort on the part of governments, civil society, the private sector and millions of individual choices and actions. To be realised, the SDGs will require a monitoring and accountability framework and a plan for implementation. A commitment to realise the opportunities of the data revolution should be firmly embedded into the action plan for the SDGs, to support those countries most in need of resources, and to set the world on track for an unprecedented push towards a new world of data for change.

Bringing together the demand for new data to inform the SDGs with the growing expectations about monitoring and accountability, and the potential provided by new technologies and ways of doing things in a responsible and privacy respecting approach, could provide the world with the step change that mobilises the data revolution on the right course and transforms societies for the better. First and foremost, the data revolution can and must be leveraged to provide more and better data, information and knowledge to more people, more often. Too many governments still lack information about crucial aspects of sustainable development. Too many people are still uncouncted. Too much data is out of date, unreliable or simply not available. Too many people are not able to access and use the data they need to make informed decisions and hold others to account.

There is much to be done, and this is the moment to do it.

2.1 The state of data

Although there have been steady and dramatic improvements in recent decades, there is still work to do to create a clearer and more up to date picture of the world, to use in planning, monitoring and evaluation of the policies and programmes that will together achieve the SDGs, and in holding to account those in positions of power over resources and other decisions that affect people's lives.

There are two main problems to address:

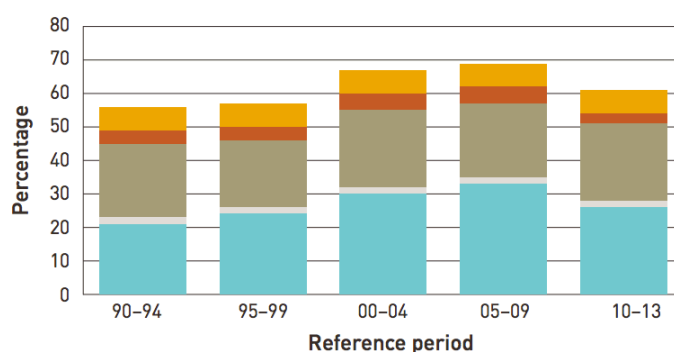
- **Not enough good quality data.** In a world increasingly awash with information, it is shocking how little we know about some people and some parts of our environment.

Despite huge improvements over the last decade, the experience from the current MDG monitoring process highlights the challenges ahead. The world has made huge strides in tracking specific aspects of human development such as poverty, nutrition, child an maternal health and access to water and sanitation. However, too many countries still have poor data, data arrives too late and too many issues are still barely covered by existing data. Data on employment, for example, is notoriously unreliable. A great deal of data is difficult to access to common citizens or is not available until several years have passed since the time of collection period.

PERCENTAGE OF MDG INDICATORS AVAILABLE FOR DEVELOPING COUNTRIES BY NATURE OF DATA SOURCE*

Nature of data source:

- Global monitoring
- Modelled
- Estimated
- Country, adjusted
- Country



* Availability is defined as the proportion of country-indicator combinations that have at least one data observation within the reference period. Figures are based on 55 MDG core indicators, as of October 2014.

Source: MDG database, maintained by UNSD

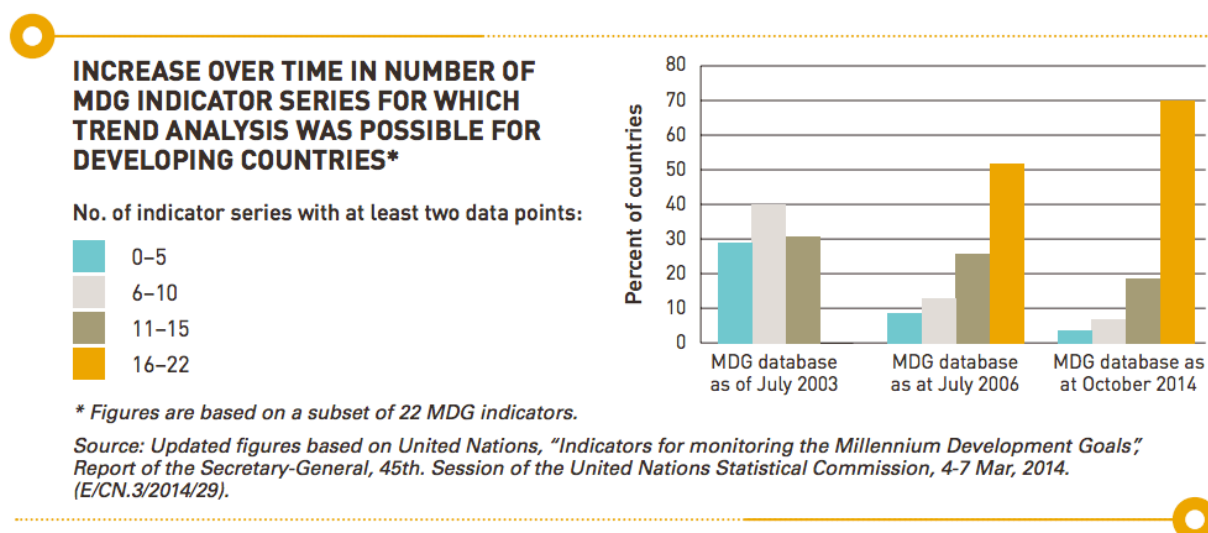
The figure above presents a summary snapshot of current data availability in the MDG database (as of October 2014), covering 55 core indicators for 157 developing countries or areas. There, a country is counted as having data for an indicator if it has at least one observation over the reference period, and availability is broken down by whether the data comes from country or international data sources, and whether it is estimated, adjusted or modelled.¹ Overall, the picture is improving though still poor. There is no three year period when the availability of data is more than 70% of what is required. The drop in data availability after 2010 demonstrates the extent of the time lags that persist between collection and release of data. Of course, there is considerable variation in data availability between indicators, where, for example, data on malaria indicators is very scarce but there is relatively good country level data available for most countries and years for the ratio of girls to boys enrolled in primary, secondary and tertiary education. While the first graph shows that MDG data availability is still low for some individual indicators and/or countries, the graph below highlights how, when looked at from a country level, there has been a tremendous improvement in the ability of national statistical systems to provide data

¹ The coding of the nature of the data in the MDG database (<http://mdgs.un.org/unsd/mdg/Data.aspx>) is as follows:

- *Country data*: Produced and disseminated by the country (including data adjusted by the country to meet international standards).
- *Country data adjusted*: Produced and provided by the country, but adjusted by the international agency for international comparability to comply with internationally agreed standards, definitions and classifications.
- *Estimated*: Estimated are based on national data, such as surveys or administrative records, or other sources but on the same variable being estimated, produced by the international agency when country data for some year(s) is not available, when multiple sources exist, or when there are data quality issues. Estimates.
- *Modelled*: Modelled by the agency on the basis of other covariates when there is a complete lack of data on the variable being estimated.
- *Global monitoring data*: Produced on a regular basis by the designated agency for global monitoring, based on country data. There is no corresponding figure at the country level.

277 directly over the past ten years (see Figure YY). This has been one of the greatest achievements of
 278 MDG monitoring, and is testament to the tremendous efforts of many national and international
 279 organisations.

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284 Beyond the MDG indicators, other huge and disturbing gaps exist. Entire groups of people and key
 285 issues remain invisible. Indigenous populations, for instance, are consistently left out of most data
 286 sets. It is still impossible to know for sure how many disabled children are in school. Globally, the
 287 birth of nearly 230 million children under age five has never been recorded. In 2012 alone, 57
 288 million infants – four out of every ten babies delivered worldwide that year – were not registered
 289 with civil authorities^{vi}.

290

291 Policy makers at national levels and below often have very little disaggregated data that allows
 292 them to compare progress one district with another and make planning decisions. In water supply,
 293 for example, many household surveys produce a single national estimate of access to clean and
 294 safe water in rural areas, but don’t show how it varies between districts.

295

296 Discrimination against women and undervaluing of their activities and priorities in every
 297 sphere has been replicated in the statistical record. Many of the issues of most concern to
 298 women are poorly served by existing data:

- 299 • only just over half of all countries report data on intimate partner violence, and where it
- 300 is reported quality is not consistent and data are not comparable;
- 301 • data on informal employment particularly in agriculture are not accurately measured,
- 302 despite women’s concentration in this sector. And much more data are needed on the
- 303 economic roles of women as caregivers to children, the elderly and the disabled in the
- 304 household and in labour force, and young women’s transition from school to work;
- 305 • some estimates show that 80% of displaced persons and refugees are women and
- 306 children, but we lack accurate data, so cannot know for certain and cannot design
- 307 assistance programmes for refugees accordingly^{vii}.

Better data sources, and better usage and linking of existing sources such as administrative and survey data, can help to overcome these inequalities in who is counted and what is known about them, but decades of experience in every sector has taught us that the systematic inequalities that hide groups from view will not be overcome without deliberate action to measure, monitor and report on the progressive elimination of inequalities. This should be a core purpose of the data revolution.

Finally, it is quite clear that **the monitoring of the SDGs will require substantial additional investment** order to consolidate gains made during the MDG era and to develop reliable, high quality data on a range of new subject matters, such as climate risk mitigation or inequality, and with an unprecedented level of detail.

Example Box

This is the revolution:

Pro-active disclosure of information was designed into India's NREGA program, which guarantees 100 days employment per year to people in rural communities. Through regular social audits, people can verify the official records and identify discrepancies^{viii}. In some cases, corruption has been identified and stopped; in many more, it has been prevented from occurring in the first place.

End box

- **Data that is not used or not usable.** To be useful, data must be of high quality and must be made accessible to those who want or need to use it. Comparability and standardisation are crucial, as they allow data from different sources or time periods to be combined, and the more data can be combined, the more useful it is. Combining data allows for changes of scale – aggregating data from different countries to produce regional or global figures. It allows for comparison over time, if data on the same thing collected at different moments can be brought together to reveal trends. Too much data is still produced using different standards – household surveys that ask slightly different questions or geo-spatial data that uses different geographical definitions. And too little data is available at a level of disaggregation that is appropriate to policy makers trying to make decisions about national level allocation or monitoring equitable outcomes. This prevents researchers, policy makers, companies or NGOs from realising the full value of the data produced.

It's not only about standards. Access is often restricted behind technical and/or legal barriers that prevent or limit effective use of data. Data buried in pdf documents, for example, is much harder for potential users to work with, though it represents an improvement on data that is only accessible to a small pool of well-connected statisticians and policy makers; administrative data that are not transferred to statistical offices; data generated by the private sector or by academic researchers that are never released or data released too late to be useful; data that cannot be translated into action because of lack of operational tools to leverage it. This is a huge loss in terms of the benefits that could be gained from more open data and from linking data across different sectors.

Box: Household Surveys and the Data Revolution

Household survey data can be of enormous value in identifying patterns of progress among different groups and using this to inform policy. For example, the Indian government's Total Sanitation Campaign, launched in 1999, has a budget of \$3.9 billion to improve access to sanitation in the country. However, data from household surveys showed that between 1995 and 2008, the the outcomes were far from satisfactory. In this period, the percentage of households from the poorest 20% of Indian society practicing open defecation fell from 99% to 95%, while among the second-richest quintile it fell from 56% to 20%. Analysis of household data by UNICEF and others has helped to inform the government's efforts to improve the targeting of subsidies, in the hope of reaching a larger number of the poorest people.

As a source of data to enhance our understanding of human development and to guide policy, household surveys, especially if augmented by data from less traditional sources, can play a big role in monitoring SDGs and contribute to and benefit from innovations in methods and technologies used to collect, manage, and disseminate micro data.

Public access is becoming the norm for internationally sponsored household surveys, which makes hundreds of micro data sets freely accessible. The International Household Survey Network (IHSN) and the Accelerated Data Programme (ADP) have made great contributions in this regard. The IHSN's Central Survey Catalogue currently holds 4,224 surveys. The ADP has helped to make the data more open, with 45% of the documented surveys accessible along with 62 national catalogues now available online^{ix}.

End box

2.2 The data we want for sustainable development

Too much that could be known remains unknown. Data could be used better to improve lives and increase the power and control that citizens have over their destinies. A cultural shift is required, towards a world where data is no longer the preserve of statisticians or computer programmers, but where everyone values, feels entitled to, and is confident navigating the growing ocean of data that surrounds us every day, and uses it in ways we cannot now imagine. Data is a new natural resource, an endless source of fuel for innovation that will power sustainable development, of which we must learn to become effective and responsible stewards.

The world we need, if the data we have is to be used to the fullest to achieve sustainable development, is a world of data that is transformed in the following ways:

- **Data for everyone.** The rules, systems and investments that underpin how official data is collected and managed need to be focused on the needs of people, while protecting their rights. These data should reflect what is important to people and the constraints and opportunities that affect their lives. The new platforms, processes and standards that disseminate data must start with what people need, not what institutions want to deliver. Rules and standards should be aimed at reducing information inequalities and providing the maximum high quality information for the widest possible number of people. The priority

should always be to use data to improve outcomes, experiences and possibilities for people in the short or long term. And data that is for people needs to be collected, stored and used in ways that protect their interests: with respect for privacy, but also with a presumption of openness, so that people themselves have access to the information and are able to make choices accordingly.

- **Data for now.** If data is to be useful and support good decision making, it has to be ready at the time when decisions are being made or where the opportunity for influencing the outcomes is there. Real time implies having feedback data before a decision becomes irreversible. New technologies and innovations provide the opportunity for the public sector, citizens groups, individuals and companies to have access to data that is aligned with their own decision making cycles and information needs – available when and how they want it - and strengthen policy planning, crisis early warning, programme operations, service delivery, impact evaluation, and disaster response. Many companies and governments are already adapting to faster and more diverse data. Around the world, satellites are used rather than survey data to monitor crop conditions, many countries use web-scraping to collect information on prices; in other cases, rather than produce their own estimates of house prices, statistical offices draw on existing private sector indices quickly available, having checked them for quality.
- **Data for the future.** Data is a key resource not just for decision making now but for future modelling and problem solving. We cannot precisely predict future needs, or know how current data could be reused in the service of complex and interconnected problems as yet unknown or unsolved. Data at different timescales will be most useful for solving future problems if they are part of a flexible and connected system, not tied to one project or research question. Data that can be reused at different scales, and combined with other data, can better reflect the complex and dynamic interactions between people and the planet. We need to begin investing in data today as a shared resource that will enable the innovations required to meet the challenges of tomorrow.

Example Box

This is the revolution

RapidFTR ([Rapid Family Tracing and Reunification](#)) is an open source mobile application used to collect vital information about children who have been separated from their families in disaster situations, and share it securely on a central database for family members looking for a missing child. RapidFTR uses the same type of security as mobile banking to ensure that family-tracing information, especially photos, is accessible only by authorized users to protect these vulnerable children. In Nyakabande transit centre in Uganda, and Rwamwanja refugee settlement camp in South Sudan, RapidFTR reduced the time required for information to become available from more than six weeks to a matter of hours, speeding up the process of family reunification^x.

Source: UNICEF

End box

Box: the value of better and more open data

As well as being important in its own right for accountability purposes, through its impact on policy and behaviour better and more open data can save money and create economic, social and environmental value. Although research in this area is still limited, modelling exercises and evidence from actual examples illustrates the scale of the potential impact of better and more open data on the economy.

- A report produced by accountancy firm Deloitte for the UK's Department for Business, Innovation and Skills estimates the economic value of the information held by the public sector in the UK and released for use and re-use to be around £5 billion per year. This includes £400 million per year as the value of lives saved from reduced death rates among cardiac patients, and time savings worth between £15-58 million from the use of real-time transport data and consequent adjustments in behaviour^{xi}.
- A report from McKinsey Global Institute puts the global value of better and more open data at \$3 trillion per year^{xii}.
- The U-report social monitoring platform established by UNICEF in Uganda has more than 260,000 young people reporting on issues that affect their communities. Early reporting of an infectious disease in banana production contributed to halting the spread of the disease, which could have cost the country \$360 million per year if left unchecked^{xiii}.
- Using mobile phone records to track the link between employee interactions and productivity, a small change in the schedule of coffee breaks at a Bank of America call centre, so that employees took their breaks together to encourage more interactions was found to increase productivity by \$15 million a year^{xiv}.

End box

What might this mean for the different institutions involved in this area? By 2020, we hope to be witnessing the emergence of a vibrant "global data ecosystem" in which:

- **Governments and other public institutions** empower statistical offices, protecting their independence, to take on the needed changes to respond to the data revolution and put in place regulatory frameworks that ensure robust data privacy and data protection, promote sharing of data by public sector, private sector, citizens groups and individuals, and build capacity for continuous data innovation in which promising new sources of data, analytical approaches and technologies tools are rapidly identified, evaluated, and mainstreamed into programme planning, operations, and evaluation.
- **Governments, international and regional institutions and donors** invest in data, to provide resources to countries and regions where statistical or technical capacity is weak, to develop infrastructures and implement standards to continuously improve and maintain data quality and usability, and to keep data open and usable by all. They also finance analytical research in forward-looking and experimental subjects.
- **International and regional organisations** provide platforms for inter-governmental dialogue and multi-stakeholder partnerships at global and regional levels to set common standards for data production, anonymisation, sharing and use to ensure that new information flows are safely transformed into global public goods, and maintain a system of quality control and audit to ensure that quality, independence, openness and privacy are respected in all systems and by all data producers and users. They also support countries in their capacity building efforts.
- **Statistical systems are empowered, resourced and independent to quickly adapt to the new world of data** to produce, process, disseminate and use high quality, open, disaggregated and geo-coded data. They might change drastically, becoming less about producing data and more about managing and curating information created outside of their organisation. They operate at a level that allows for exploitation of the possibilities of ever changing technologies and new relationships.

- **All public, private and civil society data producers** share data according to globally, nationally or regionally brokered agreements and norms, and publish data, geospatial information and statistics in open formats and with open terms of use, following global common principles and technical standards, to maintain quality and openness and protect privacy. Governments and parliaments make law and legal information available to all on a timely basis, freely, and in open standards for re-use.
- **Governments, civil society, academia and the philanthropic sector work together** to strengthen the data and statistical literacy (“numeracy”) of citizens, the media, and other ‘infomediaries’, ensuring that all people have capacity to evaluate the quality of data and use them for their own decisions, as well as to fully participate in initiatives to foster citizenship in the information age.
- **The private sector** report on their activities using common global standards for integrating data on their economic, environmental and social activities and impacts. Some companies also cooperate with the public sector, according to agreed and sustainable business models, to the production of statistical data for SDGs monitoring and other public purposes.
- **Civil society organisations** hold governments and companies accountable using evidence on the impact of their actions, provide feedback to data producers, develop data literacy and help communities and individuals to generate and use data, to ensure accountability and make better decisions for themselves,
- **The media** fairly report on the statistical and scientific evidence available on relevant dimensions of sustainable development and foster an evidence-based public discourse using advanced visualisation technologies to better communicate key data to people,
- **Academics and scientists** carry out analyses based on data coming from disparate sources providing long-term perspectives, knowledge, and data resources to guide sustainable development at global, regional, national, and local scales; make scientific data as open as possible for public and private use in sustainable development; provide feedback and independent advice and expertise to support accountability and more effective decision making, and provide leadership in education, outreach, and capacity building efforts.

509

510 **Box**

511 **Progress toward Universal Civil Registration and Vital Statistics**

512 Millions of people in low- and middle-income countries are denied basic services and protection of their
 513 rights because of deficient CRVS and national identification systems. Lacking records of their birth and civil
 514 status, they are excluded from health coverage, schooling, social protection programs, and humanitarian
 515 response in emergencies and conflicts.

516

517 A well-functioning CRVS system is also vital for policy making and for monitoring, generating statistics for
 518 policy formulation, planning and implementation, and monitoring of population dynamics and health
 519 indicators on a continuous basis at the national and local level. These data help to identify inequalities in
 520 access to services and differences in outcomes. They also improve the quality of other statistics, such as
 521 household surveys, that depend on accurate demographic benchmarks. One proven solution is through
 522 issuance of Digital Identity, which gives government and business the ability to deliver citizen services
 523 electronically, boosting efficiency and driving innovation and serving people often in isolated areas

524

Despite progress in recent years, many countries still lack the capacity, infrastructure, and resources to implement well-functioning CRVS systems. Today only one country in Africa has a complete CRVS system^{xv}.

Civil registration and national identification requires collaboration among several government ministries and technical know-how and innovative use of technologies for registering, archiving, and data management. Most of all it requires leadership, political support, and resources. In poor countries, building or extending CRVS systems will also requires the international community and donors to work together on a global program of support.

Some good news: International partners and countries have recently agreed on a CRVS Scaling Up Investment Plan^{xvi}. The plan covers activities over a 10-year period from 2015 to 2024, with the goal of universal civil registration of births, deaths, marriages, and other vital events, including cause of death, and access to legal proof of registration for all individuals by 2030. Africa and Asia have already established regional programs to motivate political support, systematic national planning, and provision of technical assistance. And key donors^{xvii} announced recently the establishment of a trust fund to support developing countries' plans to establish CRVS systems with the aim of accelerating progress toward the health-related Sustainable Development Goals.

End box

3. Mobilising the data revolution for sustainable development: a call to action

A revolution is an idea – an inspiring vision of a world of fast-flowing and free-floating information, deployed for the public good, and of citizens and governments buzzing with the excitement and possibilities it creates. But it is also a practical proposition. **Getting from here to there involves deliberate actions and choices.**

Mobilising the data revolution for sustainable development and ending information inequalities is a long and complex endeavour. **The main objective is to enable data to play its full role in the realisation of sustainable development by closing key gaps:** between developed and developing countries, between information-rich and information-poor people, and between the private and public sectors.

Decisive action now, taking advantage of the political opportunities this and next year, can set the scene and have a positive impact for years to come. **We urge the UN Member States and system organisations to dramatically speed up their work in this field,** using the post-2015 development agenda as a strong and universal policy driver to achieve significant results by 2020.

Our recommendations suggest a comprehensive programme of action in four areas, illustrated below: principles and standards, technology, innovation and analysis, capacity and resources, and leadership and governance. At the heart of the recommendations in every area are people and the planet – our revolution is with them and for them.



564

565 ***Principles and standards***

566 One of the key roles of the UN and other international or regional organisations is setting principles
 567 and standards to guide collective actions within a global community and according to common
 568 norms. We believe that mobilising the data revolution for achieving sustainable development
 569 urgently requires such a standard setting, building on existing initiatives in various domains.

570 ***We recommend ...***

571 ... that the UN develop a comprehensive strategy and a roadmap towards a new '**Global Consensus**
 572 **on Data**', setting principles and agreeing standards to build trust and enable cooperation, including:

- 573 - Agree on and promote adoption of specific principles related to the data revolution
 574 (drawing from and building upon those described in table 1, to be further developed by
 575 the appropriate UN body and agreed by their Member States);
- 576 - Accelerate the development and adoption of legal, technical, geospatial and statistical
 577 standards, in a range of areas including but not limited to:
 - 578 ○ Standards to facilitate openness and information exchange, including: statistical
 579 data and metadata exchange, technical standards for fostering the
 580 interoperability of information systems, standards for geospatial information and
 581 “geographic semantic” management and exchange; standards for open data and
 582 digital rights management and licensing
 - 583 ○ Standards to protect human rights including: standards for anonymizing data that
 584 is personally identifiable, standards and enforcement mechanisms for data
 585 security, integrity, documentation, preservation, and access

586

Table 1 - Basic Principles for Data Revolution for Sustainable Development

Bearing in mind that:

- The data revolution is critically important for sustainable development in at least four ways: it allows systematic tracking of progress on the globally agreed goals; it allows development organizations to adopt more effective and efficient ways of working; it democratizes and broadens the involvement of institutions and individuals who can access and use data and provide feedback; and it opens up unprecedented new opportunities to understand the factors that drive human behavior and design informed responses;
- The data revolution consists of the entire data ecosystem – national statistical agencies, mapping authorities, government administrative data collection systems, academia, independent think tanks, researchers, civil society, private sector, media and individuals. The role and freedom to act of each of these actors should be recognized and protected. A healthy data ecosystem is typically characterized by strong complementarities and robust engagement and free debate among these actors;
- While the data revolution is already happening, it would be incorrect to assume its effects will be inevitably positive. There are many areas where the data revolution intersects with human rights. Left alone, it is likely to reinforce existing inequities and patterns of marginalization;

For it to be useful, the data revolution will need to be harnessed for sustained and inclusive development through proactive measures and guided by the following key principles:

1. Data quality and integrity

Poor quality data can mislead. The entire process of data design, collection, analysis and dissemination needs to be demonstrably of high quality and integrity. Clear standards need to be developed to safeguard quality, drawing on the U.N. Fundamental Principles of Official Statistics and the work of independent third parties. A robust framework for quality assurance is required, particularly for official data. This includes internal systems as well as periodic audits by professional and independent third parties. Existing tools for improving the quality of statistical data should be used and strengthened, and data should be classified using commonly agreed criteria and quality benchmarks.

2. Data disaggregation

To the extent possible and with due safeguards for individual privacy and data quality, data should be disaggregated across many dimensions, such as geography, wealth, sex and age. Disaggregated data can provide a better comparative picture of what works, and help inform and promote evidence based policy making.

3. Data timeliness

Data delayed is data denied. Standards should be tightened and technology leveraged to reduce the time between data collection design and publication. The value of data produced can be enhanced by ensuring there is a steady flow of high quality and timely data from national, international, private big data sources, and digital data generated by people. The data cycle must match the decision cycle.

4. Data transparency

626 Many publicly-funded datasets, as well as data on public spending, are not available to other public
627 ministries or to the general public. All data on public matters and/or funded by public funds (with narrow
628 exemptions for genuine security or privacy concerns) should be made public and be should be "open by
629 default". The underlying data design and sampling, methods, tools and datasets should be explained and
630 published alongside findings to enable greater scrutiny, understanding and independent analysis.

631 **5. Data openness**

632 Open data is also about the way in which data is made public. It needs to be both technically open
633 (i.e. available in a machine-readable standard format so that it can be retrieved and meaningfully processed
634 by a computer application) and legally open (i.e. explicitly licensed in a way that permits commercial and
635 non-commercial use and re-use without restrictions). Data should be made public in ways that encourage
636 greater use. In particular, published data should be complete, machine-readable, freely available for re-use
637 without restrictions, and transparent about underlying assumptions.

638 **6. Data usability and curation**

639 Too often data is presented in ways that cannot be understood by most people. Data architecture should
640 therefore place great emphasis on user centred design and user friendly interfaces. Communities of
641 "information intermediaries" should be fostered to develop new tools that can translate raw data into
642 something meaningful to a broader constituency of non-technical potential users and enable citizens and
643 other data users to provide feedback.

644 **7. Data protection and privacy**

645 As more data becomes available in disaggregated forms and data-silos become more integrated, privacy
646 issues are increasingly a concern about what data is collected and how it is used. Further risk arises where
647 collectors of big data do not have sufficient protection from the demands of such information from State
648 bodies or ill meaning hackers. Clear international norms and robust national policy and legal frameworks
649 need to be developed that regulate Opt-in and Opt-out, data mining, use, re-use for other purpose, transfer
650 and dissemination. They should enable citizens to better understand and control their own data, and protect
651 data producers from demands from governments and attacks by hackers, while still allowing for rich
652 innovation in reuse of data for the public good. Within privacy constraints, people's rights to freedom of
653 expression using data should be protected – people who correctly provide, collect, curate and analyse data
654 need freedom to operate and protection from recrimination.

655 **8. Data governance and independence**

656 Many national statistical offices lack sufficient capacity and funding, and remain vulnerable to political and
657 interest group influence (including by donors). Data quality should be protected and improved by
658 strengthening NSOs, and ensuring they are functionally autonomous, independent of sector ministries and
659 political influence. This can include independent monitoring of the same public services, for example, or
660 monitoring of related indicators such as public satisfaction with services.

661 **9. Data resources and capacity**

662 There is a global responsibility to ensure that all countries have an effective national statistical system,
663 capable of producing high quality statistics in line with global standards and expectations. This requires
664 investments in human capital, new technology, infrastructure, geospatial data and management systems in
665 both governmental and independent systems, as well as information intermediaries. At the same time,
666 national capacity for data science must be developed to leverage opportunities in big data. Increased
667 domestic resources and international support for developing countries are needed to have the data
668 revolution contribute to sustainable development. Applications of big data for the public good must be
669 developed and scaled up transparently, demonstrating full compliance with applicable laws.

670

671 **10. Data rights**

672 Human rights cut across many issues related to the data revolution. These rights include but are not limited
673 to the right to be counted/right to an identity, the right to privacy/ ownership, the right to due process (for
674 example in how data is used to make decisions about people), freedom of expression, the right to
675 participation, the right to non-discrimination and equality, and principles of consent. Any legal or regulatory
676 mechanisms, or networks or partnerships, set up to mobilise the data revolution for sustainable
677 development should have the protection of human rights as a core part of their activities.

678 **End table 1**

679

680 ***Technology, innovation and analysis***

681 Technology has been and will continue to be the fundamental driver of the data revolution. To
682 harness the benefits of new technology, large and continuing investments in innovation are
683 required at all levels, but especially in those institutions which are currently lagging behind. In
684 addition, but beyond the scope of this report, and urgent effort needs to be made to increase
685 access to information technologies by, among other things, increasing access to broadband,
686 increasing literacy, including adult literacy, and increasing the use of ICT in schools worldwide.

687 ***We recommend ...***

688 ... that the UN foster the establishment of a “**Network of Data Innovation Networks (NINE)**” for
689 sustainable development bringing together a range of partners to generate knowledge and solve
690 common problems. The networks should involve existing institutions active in this field and new
691 experts, academic and research institutions, as well the private sector and official bodies. Some
692 specific areas of activity could be:

- 693 - Contribute to the adoption of best practices for improving the monitoring of SDGs,
694 through systematic research and mapping of how emerging data sources can be used for
695 measuring and fostering sustainable development. This could particularly focus on
696 linking innovators with national statistical offices to improve their effectiveness and the
697 practical uptake of innovations. Information sharing could be facilitated through the
698 production of an annual round up of “Technologies and Methodologies for Data
699 Innovation”.
- 700 - Identify areas where the development of common infrastructures to exploit the data
701 revolution for sustainable development could solve capacity problems, produce
702 efficiencies and encourage collaborations. One such suggestion would be a “world
703 statistics cloud”, to store data and metadata produced by different institutions but
704 according to common standards, rules and specifications.
- 705 - Identify critical research gaps, such as an investigation of the relationships between
706 data, incentives and behaviour to enable the creation of data dissemination policies that
707 will support rational responses by citizens.
- 708 - Engage research centres and innovators in the development of publicly available data
709 analytics tools to better evaluate long-term trends affecting sustainable development,
710 identify the most effective policies for achieving it, to make better decisions at all level
711 and support improved organizational planning, operations and evaluations.

- Create incentives, for example through prizes or data challenges, to engage social entrepreneurs, private sector, academia, media, civil society and other institutions in this global effort.

Capacity and Resources

Strengthening national capacities from data production to use will be the essential test of any data revolution, in particular in developing countries where the basic infrastructure is often lacking – preventing them from scaling-up activities and innovating to fill data gaps, improving quality, or investing in open data systems. The requirements involved in monitoring progress towards the agreed goals and targets will not be met in many countries without significant new investment. A cultural change is needed, to explicitly recognize data as a development issue just like infrastructure, health, or other key components of modern economies and societies

We recommend ...

A proposal should be developed for a **new funding stream** and innovative financing mechanisms to support the data revolution for sustainable development, for discussion at the “Financing for Development Summit”, which will take place in Addis Ababa in July 2015. The proposal should be built on the five following pillars:

- An analysis of the scale of investments needed for the establishment of a modern system to monitor progress towards SDGs, especially in developing countries. This analysis, building on various attempts currently ongoing, should highlight the costs as well as opportunities for efficiency gains associated with different production systems.
- A proposal on how to manage and monitor new funding for the data revolution for sustainable development. Taking stock of existing sources and forms of funding, this should look at how funding from a range of sources could be managed and disbursed to incentivise innovation, collaboration and whole systems approaches, while also encouraging creativity and experimentation and accepting that not all initiatives will succeed. It also should take into account the limited financial and technical absorption capacity of low income countries which in the past has hampered the up-take of new funds.
- A proposal on how to leverage the resources and creativity of the private sector. This could include the exploration of areas where a private-public partnership could be set-up to develop economically sustainable “data markets” while ensuring quality public service. Incentives for the private sector to invest with the time horizon and returns they operate with should be studied.
- A proposal to improve existing arrangements for fostering the necessary capacity development and technology transfer. This should include upgrading the ‘National Strategies for the Development of Statistics’ (NSDS) to do better at coordinated and long-term planning, and identify sound investments; engaging non-official data producers in a cooperative effort to speed up the production, dissemination and use of data, and training a new generation of leaders (especially in national statistical systems) for the new world of data.
- A proposal for a special investment to increase global data literacy. To close the gap between people able to benefit from data and those who cannot, in 2015 the UN should work with other organisations to develop a massive education program and promote new learning approaches to improve people’s, intermediaries’ and public servants’ data literacy. Recommendations could also be developed for running secondary and tertiary education

programmes to train statisticians and data scientists around the world, especially in developing countries where the need is greatest.

Governance and leadership

Strong leadership by the UN is vital to make the data revolution serve sustainable development. Such leadership should be made extremely concrete through various actions and activities, and the continuous engagement of all relevant partners, maintaining a very open and transparent approach with governments, the private sector, NGOs, the media, and academic researchers. The primary aim would be to add value to existing institutional setups, accelerating the delivery of their outputs and building new partnerships. Short- and medium-term results should be clearly spelled out, to avoid raising excessive expectations or losing momentum and credibility, and periodic reviews should be undertaken to ensure that global cooperation in this area is on the right track.

To promote some 'early harvests' on SDGs monitoring, encourage innovation and experimentation, and ensure that the possibilities of the data revolution are being fully utilised for sustainable development,

We recommend ...

- The establishment of a **“Global partnership for sustainable development data”** (GPSDD) to mobilise and coordinate as many initiatives and institutions as possible to achieve the vision sketched above. The GPSDD could promote several initiatives, such as:
 - The establishment of a biannual “World Forum on Sustainable Development Data”, and associated regional events. These would maintain momentum on data improvements, foster regular engagement between private and public actors, showcase ongoing activities and initiatives and provide practical spaces for innovation, knowledge sharing, advocacy and technology transfer.
 - Establish a “global users forum for data for SDGs”, to ensure feedback loops between data producers and users to improve the usefulness of data produced. It would also help the international community to set priorities and assess results achieved
 - Work in partnership with international and regional organisations, and other actors, to enhance coordination of work in this area, to share knowledge on SDG monitoring, encourage good practice such as open data and harmonisation, and to streamline capacity building initiatives and reduce duplicated effort, mobilizing new resources.
 - Broker some key global public-private partnerships for data sharing. Drawing on existing efforts already underway, these would provide models for best practice, useful for national and regional bodies trying to negotiate similar arrangements, would identify incentives and constraints specific to various industries, would allow for economies of scale, and would demonstrate the value and the possibility of sharing data and collaborating between public and private sectors.

- 797 - Some **‘quick wins on SDG data’** to demonstrate the feasibility of different approaches,
798 experiment and innovate with partnerships and methods as a first step to setting up
799 longer term initiatives. These could include:
- 800 ○ a “SDGs data lab” to support the development of a first wave of SDGs indicators
801 as soon as possible after they are agreed at global, regional or national level.
802 Taking into account the important experience of the interagency expert group on
803 MDGs and the whole MDG monitoring architecture, the lab should mobilise key
804 public, private and civil society data providers, academics and stakeholders to
805 identify available and missing data and indicators, as well as opportunities for
806 benefitting from new methods, analytical tools and technologies to improve the
807 coverage, timeliness and availability of indicators in each of the main SDG
808 categories.
 - 809 ○ Develop a SDGs analysis and visualisation platform to launch in September 2015,
810 using the most advanced tools and features for exploring and analysing data.
811 The development of the website would also represent a laboratory for fostering
812 private-public partnerships for data dissemination and visualisation. It would be
813 continuously updated during the lifetime of the SDGs, remaining a showcase for
814 new ideas and innovations and a source of high quality and up to date
815 information on progress.
 - 816 ○ To launch the website, establish an initiative to draw on the best, most
817 innovative and most diverse sources of data to build a dashboard on “the state of
818 the world”. This would harness the richness of traditional and new data, maintain
819 the excitement and openness of the whole SDGs process, engage think-thanks,
820 academics and NGOs as well as the whole UN family in analysing, producing
821 verifying and auditing data, provide a place for experimentation with methods
822 for integrating different data source, including perceptions data and citizen
823 generated data, and eventually produce a ‘people’s baseline’ for new goals.

824 Taken together, we believe that these recommendations could move the world onto a path of
825 information equality, where all citizens, organisations and governments have the right information,
826 at the right time, to build accountability, make good decisions, and ultimately improve people’s
827 lives.

ⁱ <http://www-01.ibm.com/software/data/bigdata/what-is-big-data.html>

ⁱⁱ http://www.unicef.org/statistics/brazil_62043.html

ⁱⁱⁱ http://www.cepal.org/publicaciones/xml/5/48385/leo2013_ing.pdf

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http://www.mckinsey.com/insights/high_tech_telecoms_internet/lions_go_digital_the_internets_transformative_potential_in_africa

^v http://earthobservations.org/documents/ministerial/geneva/MS3_GEO%20Report_on_Progress_2011_2013.pdf

^{vi} United Nations Children’s Fund, *Every Child’s Birth Right: Inequities and trends in birth registration*, UNICEF, New York, 2013.

^{vii} Mapping Gender Data Gaps” www.data2x.org

^{viii} <http://www.mgnrega.co.in/>

^{ix} <http://catalog.ihsn.org/index.php/catalog>

^x http://www.unicef.org/infobycountry/uganda_70090.html

^{xi} <https://www.gov.uk/government/publications/public-sector-information-market-assessment>

^{xii} Chui, M. Farrell, D. and Jackson, K. (April 2014). “How government can promote open data”. McKinsey&Company. Available from http://www.mckinsey.com/insights/public_sector/how_government_can_promote_open_data

^{xiii} <http://blogs.worldbank.org/youthink/how-youth-saved-bananas-uganda>

^{xiv} Pentland, A., The Data Driven Society, Scientific American, October 2013, pp. 78-83

^{xv} http://www.uneca.org/sites/default/files/uploaded-documents/CRVS/2015/death_registration.pdf

^{xvi} Global Civil Registration and Vital Statistics Scaling Up Investment Plan 2015-2024 by the World Bank and WHO

^{xvii} The World Bank Group and the governments of Canada, Norway, and the United States