



THE STATE OF MOBILE DATA FOR SOCIAL GOOD REPORT

JUNE 2017





Global Pulse is an innovation initiative of the United Nations. The Initiative works to promote awareness of the opportunities big data presents for sustainable development and humanitarian action, forge public-private data sharing partnerships, generate high-impact analytical tools and approaches through its network of Pulse Labs, and drive broad adoption of useful innovations across the UN System.

For more information, please visit the UN Global Pulse website at www.unglobalpulse.org.

Follow UN Global Pulse on Twitter: [@UNGlobalPulse](https://twitter.com/UNGlobalPulse).



The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with almost 300 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai, Mobile World Congress Americas and the Mobile 360 Series of conferences.

For more information, please visit the GSMA corporate website at www.gsma.com.

Follow the GSMA on Twitter: [@GSMA](https://twitter.com/GSMA).

CONTENTS

EXECUTIVE SUMMARY1

INTRODUCTION AND CONTEXT2

Purpose of the Report4

Mobile Data in Brief5

Mobile Data for Social Good5

Landscape of Mobile Data for Social Good8

Stakeholders in Mobile Data for Social Good10

CHALLENGE AREAS12

 Lack of a strong evidence base to support investment13

 Lack of a shared vision and cohesive implementation mechanism14

 Lack of common approach to data privacy and risk mitigation associated with data use14

 Lack of technical capacity globally and in LMICs18

RECOMMENDATIONS20

 Identify and build sustainable business models21

 Address gaps within the data privacy and data protection landscape and mitigate risks22

 Build capacity in the right places24

 Create global tools for public good24

PROPOSED MILESTONES FOR 201826

Design and Conduct an Impact Demonstration Project27

 Step 1: Bring key leaders from the involved sectors together28

 Step 2: Build a community-driven roadmap for the impact demonstration project28

 Step 3: Secure catalytic funding for roadmap activities30

 Step4: Create a public-private partnership to oversee the demonstration project30

CONCLUSION33

ANNOTATED BIBLIOGRAPHY34

ACKNOWLEDGMENTS

This report was produced by UN Global Pulse and the GSMA with support from Vital Wave Consulting. Appreciation goes to colleagues from the two organizations who spearheaded the preparation of this report and provided their expertise in outlining the content of the paper. The report also benefited from the expertise and knowledge of representatives of international development agencies, mobile network operators, civil society organizations and technical data experts.

UN Global Pulse wishes to thank the Vodafone Americas Foundation for its generous financial support as well as its technical advice in the preparation of the report.

EXECUTIVE SUMMARY

In September 2015, Member States of the United Nations adopted, by consensus, the 2030 Agenda for Sustainable Development. The 17 Sustainable Development Goals (SDGs) contained in the 2030 Agenda constitute a transformative plan for people, planet, prosperity, partnerships and peace. A 'data revolution' was recognized as an enabler of the SDGs not only to monitor progress but to inclusively engage stakeholders at all levels to advance evidence-based policies and programs to reach the most vulnerable.

One of the key sources of data needed to unlock this potential is the range of data generated from mobile networks and devices. Insights about population movements, density, location, social patterns, finances and even ambient environmental conditions can be derived from the data logged in mobile systems. As this data is uniquely detailed and tractable, it can capture information not easily found from other sources at a scale that would be difficult to recreate through other means.

Experts across sectors have suggested that despite its potential, the use of mobile data for social good remained largely in the pilot phase, a situation common to many cutting-edge fields. While the examples to date are compelling in showing the range of potential uses for this data to serve the social good, including the achievement of the SDGs, the lack of examples that have scaled or become sustainable indicates there are still gaps in the field.

This report outlines the value of harnessing mobile data for social good and provides an analysis of the gaps. Its aim is to survey the landscape today, assess the current barriers to scale, and make recommendations for a way forward.

The report reviews the challenges the field is currently facing and discusses a range of issues preventing mobile data from being used for social good. These challenges come from both the demand and supply side of mobile data and from the lack of coordination among stakeholders. It continues by providing a set of recommendations intended to move beyond short-term and ad hoc projects to more systematic and institutionalized implementations that are scalable, replicable, sustainable and focused on impact. Finally, the report proposes a roadmap for 2018 calling all stakeholders to work on developing a scalable and impactful demonstration project that will help to establish the value of mobile data for social good.

The report includes examples of innovation projects and ways in which mobile data is already being used to inform development and humanitarian work. It is intended to inspire social impact organizations and mobile network operators (MNOs) to collaborate in the exploration and application of new data sources, methods and technologies.

The 'State of Mobile Data for Social Good' is informed by a series of expert interviews with representatives of the United Nations, NGOs, MNOs, and data experts, as well as by analysis of case studies involving the use of mobile data. It also draws from the body of existing literature, and a number of consultations at recent conferences and workshops related to uses of mobile data for social good.

INTRODUCTION AND CONTEXT

The near ubiquity of mobile phones is allowing people to leapfrog legacy communication technologies and traditional information systems. Mobile phones have changed the paradigm for how people obtain services, access information, and connect with friends and family. The number of unique mobile subscribers has surpassed the five billion mark in 2017. Mobile users include nearly everyone in the developed world and 62 percent of the population in low and middle-income countries (LMICs)¹. By 2020, nearly three billion people worldwide will own smartphones, and the forecast in Africa for 2018 is double what it was in 2014².

Insights generated from mobile phones and apps have already disrupted and transformed industries. For example, over 277 mobile money services are now offered across 92 countries enabling previously unbanked people to access banking services. In the energy sector, 5.5m people have been able to switch from harmful energy sources (e.g. kerosene) to clean renewable energy through a “pay as you go” solar model that leverages mobile money as a key enabler. In addition, a number of apps use data extracted from GPS receivers in mobile phones to pinpoint the geographical location and daily routine of clients to provide relevant services. For example, pushing ads and e-coupons to mobile users based solely on their approximate location has become a well-cemented business model. When appropriately aggregated, and with privacy safeguards in place, location data can also be used to provide unique insights into human behavior and unlock new opportunities for improving key development sectors such as health, financial services, agriculture, as well as response to humanitarian crises.

Mobile network data (mobile big data)—the vast quantity of information that is produced as a passive by-product of the use of mobile services—holds great promise as a transformative resource for social good. Business models based on analysis of mobile data to generate consumer insights are exploding, and MNOs around the world are investing heavily in the tools and expertise needed to enhance services for subscribers, while respecting their privacy preferences. At the same time, numerous pilot and research projects have shown the feasibility of using mobile data to predict or track disease outbreaks, improve transportation flows, and to respond more effectively in humanitarian crises.

For the development community, the Sustainable Development Goals³, which were adopted by Member States of the United Nations in September 2015, are a blueprint for the current and future priorities in development and humanitarian efforts. They consist of a set of 17 goals, each with specific targets to be achieved by 2030, spanning topics from economic opportunity to coping with climate change. In 2015, UN Secretary-General Ban Ki-moon called for a Data Revolution to enable that transformation and to hold the world accountable for progress on the SDGs. Analysis of big data can yield insights that reveal invisible or sometimes counterintuitive patterns of human behavior that could provide entirely new paradigms for development programs.

Data are the lifeblood of decision-making and the raw material for accountability. Without high-quality data providing the right information on the right things at the right time, designing, monitoring and evaluating effective policies becomes almost impossible.

—United Nations, IEAG on a Data Revolution, *A World that Counts*, 2014⁴

1 Matthew Iji. GSMA Intelligence. February 28, 2017. Accessed April 15, 2017 <https://www.gsmaintelligence.com/research/2017/02/uniquemobile-subscribers-to-surpass-5-billion-this-year/613/>

2 Christopher Bendtsen, Marcus Johnson, Alison McCarthy, Oscar Orozco, Monica Peart, Shelleen Shum, Martín Utreras, Haixia Wang. eMarketer. August 2015. Mobile Users: eMarketer’s Updated Estimates for 2015. Accessed April 15, 2017 https://insights.ap.org/uploads/images/eMarketer_Estimates_2015.pdf

3 Accessed April 17, 2017 <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

4 A World that Counts: Mobilising the Data Revolution for Sustainable Development. November 2014. Accessed April 15, 2017 <http://www.undatarevolution.org/wp-content/uploads/2014/11/A-World-That-Counts.pdf>

The challenges in deriving social good-oriented insights from mobile data, however, are substantial and have stalled development of the field. They include a lack of understanding by policy makers and humanitarian and development practitioners on the potential of mobile network data and a lack of enabling regulatory frameworks that would empower the mobile sector to share data and insights, which can be invaluable for improving and saving lives.

Other challenges include risks of data misuse and potential of harms to those whose data is being used as well as negative consequences for those who are collecting and using the data, like reputational damage or legal liability. For instance, the very same attributes that make mobile data so valuable for targeting humanitarian assistance to populations displaced by a natural disaster—the fact that it contains information about location, time, and patterns of movement—can also lead to the invasion of privacy of mobile subscribers and those who are part of their social networks. Though many would benefit from the insights of this data, the potential negative consequences are significant and require strong risk management techniques.

Nonetheless, while there are certain risks and costs associated with using mobile data to produce social good insights, there may also be risks and harms associated with a failure to include this and other new data sources to inform policy, humanitarian response and other development interventions.

In the absence of clear guidance and standards governing the safe and responsible use of mobile data for social good, many potential users of insights from mobile data—as well as MNOs—are understandably hesitant to engage.

The emerging mobile data ecosystem has reached an inflection point where the right actions by the right stakeholders could serve to consolidate fragmented efforts and propel the field forward. The challenges that have stalled the large-scale use of mobile data for social good cannot be solved by any one actor. International Organizations including UN agencies, Governments, non-profits, and MNOs all have a role to play in creating an enabling policy environment and novel methods and models of interacting within the highly regulated mobile industry.

Purpose of the Report

This report examines the successes and challenges in the use of mobile data for social good and identifies concrete next steps that could lead to the scaled and systemized use of mobile data in the development and humanitarian sectors.

The report is the result of research into fifteen case studies where mobile data were used for social good, thirteen expert interviews, and a workshop at the UN World Data Forum in January 2017. In addition, the rich and growing body of literature on the use of mobile data for disaster response, health, social programs, transportation, crime and national statistics has been surveyed for further insights.

The intended audience for this report includes a range of stakeholders whose collaboration is essential to realize the potential of mobile data for social good: mobile network operators, development and humanitarian organizations, government ministries, mobile industry regulators, universities, and private-sector data analytics companies. Cooperation among this diverse set of stakeholders has great potential to drive transformative social and economic impact, but the path is not straightforward. This report will enable stakeholders to capitalize on an immense yet still largely untapped opportunity to improve development and humanitarian outcomes through new insights into human behavior on a massive scale. Getting there will first require aligning efforts to a common outcomes framework, and creating concrete mechanisms for proving the social value of insights generated from mobile data. From this work, a roadmap to scale can be developed.

Mobile Data in Brief

For the purposes of this report, mobile data is defined as information elements contained in call detail records, or CDRs. CDRs are created whenever an individual interacts with the mobile network. They are used by MNOs for billing purposes.

Specific data elements include at least the following information:

- › Phone number originating the call (calling party, A-party)
- › Phone number receiving the call (called party, B-party)
- › Starting time of the call (date and time)
- › Call duration
- › Cell tower through which the call entered the exchange
- › Cell tower through which the call left the exchange
- › Call type (e.g., voice, SMS)

Once anonymized and aggregated to appropriate levels, CDRs can provide a variety of insights with tremendous value for development or humanitarian organizations, including⁵:

- › **Mobility.** As calls and messages are sent and received through the cell towers of a mobile network, records are produced that can reveal community or population-level movements. This data has particular relevance in the wake of natural disasters or disease outbreaks, but it may also be used for urban planning.
- › **Social Interaction.** Information about how groups of individuals engage with their social community, including who they call, how often they speak with these contacts, and how long they speak with them, can be used to understand behavior and socio-economic trends.
- › **Economic Activity.** Monthly airtime top-up patterns, consumption of value-added services (VAS), and the use of mobile financial services can be used to extrapolate insights about the economic health and resilience of a community.

Mobile Data for Social Good

For the purposes of this report, ‘mobile data for social good’ is the use of mobile data to improve development programs, humanitarian action, and the production of official statistics.

“When I think about big data in telecommunications, I think about the 350 million customers we serve worldwide and the 23 billion mobile events they create every day in 21 countries. When I think about social good, I think about the commitments we have all made with the UN when it comes to the 17 Sustainable Development Goals for 2030, which represent 169 targets with 241 proposed indicators. Forging a relationship between our big data work for social good is fundamental, especially as 80% of the 6 billion mobile phones in the world are in developing countries, which is where we can have the greatest impact.”

—Jose Maria Alvarez Pallete, Chairman of Telefonica⁶

5 United Nations Global Pulse. “Mobile Network Data for Development”. October 2013. http://www.unglobalpulse.org/sites/default/files/Mobile%20Data%20for%20Development%20Primer_Oct2013.pdf

6 Jose Maria Alvarez Pallete, Chairman of Telefonica. World Economic Forum Blog.

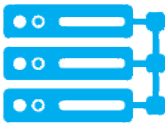
While there is a great deal of big data being generated by people every day (through the use of social media, credit card transactions, satellite imagery and more) at least three unique factors make insights derived from CDRs particularly relevant and promising for the social sector:



Mobiles are ubiquitous, including in the developing world. Global mobile subscriber penetration is 63%, and 90% of new subscribers are forecast to come from the developing world.



Mobile phone usage produces data related to location, movement, mobility, and environment. When combined with more traditional sources like census, health, or weather data, mobile data can support humanitarian and development goals.



Data about mobile networks and usage is already being captured, stored, and secured by MNOs. The opportunity exists for the development and humanitarian communities, as well as governments to work with MNOs to apply thoughtful, creative, and privacy-respective layers of analysis on this data in order to extract useful insights.

The two case studies below illustrate the types of lifesaving insights that can be produced through the use of mobile data.

Converting massive amounts of mobile data into meaningful insights is done first through data analytics, the application of hardware and software to detect patterns. This analysis often involves advanced methodologies from the fields of network science, machine learning and artificial intelligence. Mobile data are analyzed and the resulting insights are supplied to policy-makers and program managers primarily by academic researchers, non-profit organizations, and MNO research labs.

These insights are almost always combined with other data sources to contextualize them into actionable steps. Whether or not the insights are truly actionable is dependent on the capabilities and resources of development and humanitarian practitioners. For example, the ability to predict a disease outbreak only translates into prevention of that outbreak when the required resources, policies and expertise are in place to ensure an effective, proactive response.

CASE STUDY: Predicting dengue fever outbreaks more quickly in Pakistan

Key benefit of mobile data: For infectious diseases, time is critical for stopping an outbreak. Real-time data on social mobility provides an early warning, which allows countries to respond more effectively or even prevent outbreaks altogether.

Dengue fever, the most rapidly spreading mosquito-borne viral disease in the world, is endemic in Pakistan and has spread due to human travel and hospitable conditions for mosquitoes, resulting in severe illness and significant mortality. Accurate predictive models are needed for epidemic preparedness and containment of the virus.

Results: Anonymized call data from almost 40 million Telenor Pakistan subscribers during the 2013 dengue outbreak were used to predict the spread and timing of the disease. Mobile data allowed health officials to predict outbreaks days or weeks earlier than they could through traditional means. The resulting model contributed to the design of better national response mechanisms in Pakistan and other at-risk nations, and showed the potential for CDRs to accurately reveal mobility patterns that can predict the spread of disease.

Success factors:

- › A strong partnership of diverse organizations: Telenor Research, Harvard T.H. Chan School of Public Health, Oxford University, the U.S. Centers for Disease Control, and the University of Peshawar.
- › Project setup focused on privacy principles, regulatory requirements, and building a team with the right mix of skills.
- › Extensive privacy and data processing protocols were designed and monitored.
- › CDR/mobility data were processed on a backup and recovery server belonging to Telenor Pakistan.
- › Only Telenor employees had access to detailed CDR/mobility data.
- › No detailed CDR/mobility data were taken out of the country or left Telenor Pakistan's premises.
- › Aggregated data were at tower level, accessed only by Telenor employees. Further spatial aggregations were made available to other study participants.

CASE STUDY: Tracking human migration in Nepal following an earthquake

Key benefit of mobile data: Real-time insights into population mobility allows more effective targeting of relief resources.

Displaced people are often the most vulnerable in disaster settings. Traditional methods of tracking population movements are slow and unreliable. Near real-time movement patterns can be revealed using anonymized mobile phone call detail records.

Results: Following the 2015 Gorkha earthquake in Nepal, estimates of national level population movements were derived through the analysis of anonymized CDRs from N-Cell's 12 million mobile subscribers. Insights and maps were made available to humanitarian response organizations, to aid and inform disaster relief efforts. This was the first time that analysis derived from CDRs was included in an official operational report from the UN.

Success factors:

- › Strong partnership between Flowminder (NGO), N-Cell (MNO), and World Pop.
- › Data access agreements were already in place six months before the earthquake hit.
- › GSMA privacy guidelines developed during the Ebola outbreak were followed.
- › Ncell made data available to Flowminder via a server set up in their data center. All analyses were performed on this server and only aggregated data were transferred out.
- › The modeling frameworks and analyses have been tested in many pilot studies and are now moving into operations

Landscape of Mobile Data for Social Good

To understand the potential value of mobile data use in the social good context, it is helpful to understand the sectors in which studies have been conducted and the stakeholder groups participating in this work.

Over 200 projects were identified through a literature search and discussions with data use experts. All of these projects combined mobile data with other data sets in their analyses.

Three types of use cases emerged:

- › **Humanitarian Action and Crisis Response.** Support prediction, preparation, prevention, response and recovery from natural and human-made disasters and crises.
- › **Global Development.** Diagnose and address long-term social issues by providing objective insights into people's lives and behaviors, allowing users to design and target programs and policies more effectively and inform decision-making processes.
- › **Official Statistics, Planning and Impact Evaluation.** Track progress against the 2030 Agenda for Sustainable Development. Create indicators that allow users to track the progress of programs with high temporal frequency and provide updated insights that can be a proxy or can complement traditional data collection methods and support program evaluation and national statistical offices⁷.

Each of these categories is further characterized in Table 1. The table illustrates the programmatic value, the timeframe of the effect, and the description of a representative project.

Most of the 200 projects identified in the literature review were scientific research or feasibility studies, some of which were operationalized. These studies generally ask: "Can something be done, should we proceed with it, and if so, how?"⁸ The feasibility studies and pilot projects have thus far demonstrated that:

- › MNOs are willing to participate in social good projects.
- › Data can be made accessible for use in ways that protect subscriber privacy.
- › Academics and social impact organizations can partner with MNOs in ways that protect privacy.
- › Governments have found ways to successfully partner on projects with MNOs and third parties.
- › Development and humanitarian donors are willing to fund mobile data for social good projects.
- › Mobile data when combined with traditional data sources may be used to generate information that is richer, more precise, or less costly than is possible with traditional sources alone.
- › Mobile data may yield unique and valuable insights that cannot be obtained from traditional data sources.

Tremendous progress has been made in modelling data access arrangements, creating multi-sectoral partnerships, and identifying the types of insights mobile data can yield.

However, none of the studies examined were operating at scale, or were in the process of scaling up. As a consequence, evidence at the outcome or impact level is lacking. It is therefore critical to understand the roles that different stakeholders can play in overcoming the barriers to scale.

7 Grant Tudor, "The Age of Big Data," NextBillion.net, October 20, 2011, <http://nextbillion.net/the-age-of-big-data/>

8 SM Eldridge, GA Lancaster, MJ Campbell, L. Thabane, S. Hopewell, CL Coleman, CM Bond. Defining Feasibility and Pilot Studies In Preparation For Randomised Controlled Trials: Development Of A Conceptual Framework. PLoS One. 2016 Mar 15;11(3):e0150205. doi:10.1371/journal.pone.0150205. eCollection 2016.

Table 1. Characteristics of Mobile Data Projects

PROGRAM VALUE	TIMEFRAME OF EFFECT	CASE STUDY EXAMPLE
HUMANITARIAN ACTION AND CRISES RESPONSE		
<p>In the context of humanitarian emergencies, insights from mobile data have high potential for use in assessing population vulnerability, estimating the risks of certain hazards (e.g., disease outbreaks), measuring disaster impacts, coordinating response efforts, and monitoring progress on recovery.</p>	<p>Most useful when available and accessible in real time. Platforms that utilize this data must be ready to be deployed in advance of a crisis. This has been a challenge in the past, as evidenced by the response to the Ebola crisis⁹.</p>	<p><u>Understanding population displacement with mobile data</u> International relief agencies used Flowminder reports (based on mobile data) to create a national assessment of food security following the 2015 Gorkha earthquake in Nepal. The reports revealed national and district-level numbers on displaced populations, allowing organizations to focus support efforts¹⁰.</p>
GLOBAL DEVELOPMENT		
<p>Mobile data is particularly effective in development settings when used with other data like demographic, census, satellite, remote sensors, or even weather patterns. This enables a more complete picture of the interrelated factors contributing to the economic, agricultural, health, or overall well-being of a community. Development context is yet to be considered by regulatory frameworks as a unique case for data use. While highly granular and significantly aggregated community level data can be useful, considerations for each context should also include performance of risks assessments.</p>	<p>Need not always be provided in real time. Retrospective data is useful, because development programs often benefit most from insights about long-term habits, behaviors and patterns. Early detection of anomalous changes in behavior may be used to proactively address emerging risks to outcomes.</p>	<p><u>Mobile data to improve transportation systems</u> LIRNEasia used mobile data to track and map daily changes in population densities in Colombo, the capital of Sri Lanka. Their analysis was shared with city officials to help improve the transportation system, land use regulations, and social services. The project is one of many under the “Smart City” umbrella^{11, 12}.</p>
OFFICIAL STATISTICS, PLANNING AND IMPACT EVALUATION		
<p>Used with traditional data sets or advanced forms of data collection (e.g., satellites or remote sensors), mobile data can unlock critical insights for national policy and planning, both prospective and retrospective. In the developing world, usage patterns such as multiple SIM ownership, phone sharing, and limited handset access for the poor and (in some geographies) women may also present certain risks. Particularly, the risk of bias must be accounted for when mobile data are used to represent the entire population.</p>	<p>The imperative for real-time data may be less, though having automated systems in place is important for long-term accuracy and utility.</p>	<p><u>Mobile data as a proxy indicator for census maps</u> In Latin America, five months of CDRs from 10 million subscribers were combined with country-wide census data to draw a correlation between socio-economic indicators and patterns of mobile usage. The study was conducted by Telefonica Research and aimed to provide an affordable tool that could be used by decision-makers with limited resources¹³.</p>

9 “Waiting on Hold,” The Economist, October 25, 2014, Science & Technology

10 Kurt Burja, United Nations World Food Programme, <http://www.flowminder.org/case-studies/nepal-earthquake-2015>

11 <http://lirneasia.net/projects/bd4d/> Accessed May 10, 2017.

12 <http://www.scidev.net/south-asia/governance/analysis-blog/big-data-can-make-south-asian-cities-smarter.html>. Accessed May 10, 2017

13 United Nations Global Pulse. Mobile Phone Network Data for Development, October 2013. Page 7.

Stakeholders in Mobile Data for Social Good

Table 2. Stakeholders in the Mobile Data for Social Good Space

	GOVERNMENTS (MINISTRIES AND NSOS)	GENERAL PUBLIC	DONORS	INTERNATIONAL ORGANIZATIONS/ NGOS	RESEARCHERS/ ACADEMICS	PRIVATE SECTOR (MNOS)
ROLES	Data User, Data Provider (complementary data)	Data Beneficiary, Data User	Data User, Donor	Data Translator, Data User, Data Steward	Data Translator, Data User	Data Provider (mobile)
ENABLING ATTRIBUTES	<p>Have or can access traditional data sets to complement mobile data (e.g., health data)</p> <p>Possess significant leverage (e.g., access to country leadership) and specialized understanding of local challenges</p>	<p>Benefit the most from improved social programs</p> <p>Hold power on appropriate use through collective public opinion as citizens and customers</p> <p>Should increasingly benefit from having direct access to insights generated from aggregated mobile data</p>	<p>Control catalytic funding for early innovation to establish proof of concept in multiple areas</p> <p>Able to coordinate with other like-minded donors to bring cohesion to a sector and to fund programs at scale</p> <p>Multi-national experience</p>	<p>Usually have trust of citizens and other stakeholders as neutral entities</p> <p>Enjoy specialized knowledge of the realities and the challenges with on-the-ground infrastructure and operations</p> <p>Multi-national experience</p>	<p>Proficient in data science and able to innovate and maximize the full potential of mobile data</p> <p>Data expertise leads to clear ask of the mobile network operator, potentially streamlining these often-lengthy negotiations</p>	<p>Can advance reputational objectives and positively affect employee morale</p> <p>Can benefit from “analytical spillover” that produce insights for new products and marketing strategies, and VAS that expand customer base¹⁴</p> <p>Can leverage data assets that have already been collected and stored</p>
POTENTIAL ROAD-BLOCKS	<p>Lack of resources, both human and financial to access and utilize new data sets</p> <p>Many regional and country-level differences in the way data utility is perceived and regulated</p>	<p>May not know about the benefits (and risks) associated with use of their data</p> <p>Concerns about re-identification persist</p> <p>Uninformed public can create challenges and risks</p>	<p>Sunk costs in traditional data systems may limit innovation</p> <p>Coordinating with other donors can be a long and slow process</p>	<p>May be reliant on donor funding, which is often short-term and prescriptive</p> <p>Lack of experience working with the commercial side of MNOS. May be more familiar with CSR agreements</p> <p>Lack of capacity and technical skills to integrate insights from big data</p>	<p>Research projects may be constrained by narrow objectives and protocols or unresponsive to new opportunities</p> <p>Subject matter silos may exist in academic-led research</p> <p>Results may be academically interesting but unlinked to programmatic action and benefit</p>	<p>Operate in highly regulated environments with strict laws on privacy and data sharing</p> <p>Ultimately beholden to customers who may express concerns about data use</p> <p>May not be eager to share insights based on mobile data that may prove useful to a competing company^{15,16}</p>

14 Caroline O. Buckee and Kenth Engo-Monsen, “Mobile Phone Data for Public Health: Towards Data-Sharing Solutions that Protect Individual Privacy and National Security,” Telenor Report 2/2016, October 29, 2014, page 3

15 Big Data: Moneymaker and force for Social Good, Ana Zamora, Telefonica Blog, Thursday, 12 January 2017. Also The Six Challenges of Big Data for Social Good, Richard Benjamins 25 October 2016 Telefonica Blog

16 Data Philanthropy: Where are we now? Andrea Paweke and Anoush Rima Tatevossian, May 8, 2013.

There are many different stakeholders (Table 2) in the mobile data for social good field, and all play a role in converting mobile data into actionable insights. The large number of stakeholder groups—and the plethora of organizations and individuals who make up these groups—can create a complex environment for implementing solutions. Every setting will have a specific set of stakeholders; identifying and engaging those stakeholders is essential to forging effective partnerships.

A dance of interdependence occurs between and among stakeholders, as the blocking actions of one can be overcome through the enabling work of another. For example, public sector actors can change their regulatory frameworks to allow use of mobile data while still protecting the information of the general public. In turn, these actions reduce the risk of engagement for MNOs.

In fact, there are roles that must be filled by some combination of stakeholders. Beneficiaries, for example, are seldom party to mobile data use agreements, but their needs are the guiding force for project design, execution and evaluation. The primary roles in mobile data for social good initiatives include:

- › **Data Beneficiary.** Made up of individuals, a target population, or a government, it is this group's needs and circumstances that define the problem statement. While in practice this group may be a silent partner, maintaining its interests is critical to partnership dynamics.
- › **Donor.** For the foreseeable future, mobile data for social good projects will rely on donor funding. Donors can play an instrumental role in focusing their investments for larger impact.
- › **Data Provider.** Often the mobile network operator (as custodian of mobile users' data). MNOs have access to data about how mobile users use their network. Such data may also be combined with one or more other types of data provided by third parties, such as official statistics, retail sales, money transfers, satellite imagery, or social media content.
- › **Data User.** May be a research institution, social impact organization, data analytics provider, or government ministry. Uses data to plan interventions, programs, policies and strategies.
- › **Data Translator.** May be in-house personnel at the MNO, or could be an international organization or NGO. This role typically must possess design and data analytics skills to act as a translator between the Data User and the Data Provider. Their actions are guided by a contractually agreed upon privacy framework for personal data use.
- › **Data Steward.** May be an International Organization, an NGO, or research institution. Their role is to monitor and evaluate whether the data provided conform to agreed standards. An important additional responsibility of the Data Steward would be to interface with the media, both proactively and in the event of a crisis. The Data Steward may also serve as the Data Translator.
- › **Data Producer.** A mobile subscriber—who is using digital devices and in doing so is creating data that is collected, aggregated and used by Data Providers.

The preceding sections have defined mobile data, described the value of mobile data for social good, and reviewed the roles that stakeholders play. The next section details the challenges that prevent more widespread use of mobile data for social good.

CHALLENGE AREAS

A range of issues preventing mobile data from being used for social good has been documented in the reviewed literature and was emphasized in interviews with experts. These challenges arise from both the demand and supply sides of mobile data, and from the lack of a bridge between the two. Proposed solutions to overcome these challenges are described in the Recommendations section of this report.

Lack of a strong evidence base to support investment

There is a perception among some stakeholders that mobile data for social good is stuck at the “peak of inflated expectations” stage of the hype cycle. In resisting the hype, however, it is possible that the development community is missing an opportunity.

We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run.

—Roy Amara, former president of The Institute for the Future

While pilot and feasibility projects have proven the viability of mining mobile data for new insights, the ability to use those insights for greater program impact has not yet been demonstrated. The need for an evidence-based case for investment is shared by International Organizations, NGOs, donors, governments and MNOs. Each of these stakeholders needs demonstrated proof that programs employing mobile data can measurably benefit or save human lives, and that these programs possess the critical characteristics necessary for scale and sustainability. Only if the benefit is clear, compelling, and documented will there be a movement toward mainstreaming the use of mobile data for social good.

The first steps in proving the value of mobile data for social good will likely be driven by a donor, in partnership with a public sector organization such as a government or international organization and an MNO. As the field evolves, commercial models will be required to guide scale-up strategies of social good applications. While urgent humanitarian applications where lives are at stake are unlikely to serve as the basis of a new business model and may always depend to some degree on the pro bono support of business, the myriad applications of mobile data that support development progress (e.g., in transportation, health, or agriculture) have significant potential to achieve sustainability.

CEOs will need to know that other stakeholders recognize the reality that they are running a for-profit business and cannot reasonably be expected to make mobile data available at a loss in every case where there is potential social good value. Just as the majority of mobile services that today contribute to global development are not free, many of the mobile data-powered services mentioned in this report (e.g., production of official statistical indicators) may need to be supported by a business model. At the same time, just as mobile flood alerts today are broadcast at no cost to subscribers, in cases where lives are at stake, pre-agreed sets of analytic insights might be provided for free to approved stakeholders (e.g. those who are empowered to act on the data and save lives). In other words, data for social good initiatives or services need to have a sustainability model—ideally one in which the business case is not only strong enough to ensure access to insights, but one in which it represents enough of a market to spur ongoing reinvestment in innovation. For example, in suitable cases, evidence of a commercial relationship that could drive ongoing involvement would help MNOs commit to social good activities.

The development sector should not underestimate their ability to pull MNO involvement forward by articulating a clear business case for mobile data usage. Data Users and Data Stewards must also share in the responsibility for protecting privacy and addressing legal and regulatory issues.

While data philanthropy is very important to start the social good movement, in the long run, we expect progress to be much quicker if there are also commercial opportunities. Companies are simply more willing to invest in something with a business model.
—Richard Benjamins, Director of External Positioning & Big Data
for Social Good at LUCA, Telefonica Data Unit¹⁷

Lack of a shared vision and cohesive implementation mechanism

Many players in the development field have recently begun innovation initiatives in big data and mobile data. Regular convenings and meetings are held to discuss results of pilot tests. These pilots and initiatives spawn numerous activities, but the sum of these efforts fall short of the critical mass needed to propel the field into scaled adoption of mobile data solutions. What is lacking is a higher-level vision and plan, such as a technology roadmap, to which these activities and solutions can be aligned.

The use of mobile data for social good has been driven by innovators, who in this case are the “technologists.” In order to scale and systematize the use of mobile data, however, the lead position needs to shift to policymakers and decision-makers. This transition from advocates to practitioners is exceedingly difficult. Many fields stall for decades before moving work that is primarily in the research realm into policy and practice.

There are a few nascent initiatives aimed at organizing parts of the field. For example, the GSMA’s Big Data for Social Good Initiative aims to organize MNOs¹⁸, the Global Partnership for Sustainable Development Data¹⁹ focuses on data use for policy and program decision-making, and the Digital Impact Alliance²⁰ focuses on digital services across the development spectrum. These efforts could be strengthened by further cross-sector engagement and a unifying overarching framework or strategy.

Different stakeholders—private sector, regulatory community, humanitarian and development experts, technologists—must work together to find a common ground and enable the shift from advocacy and pilots to operations. One effective approach to achieve this synergy is to form public-private partnerships (PPP). The PPP lives in the space between the stakeholders and knits the various interests together under a common vision and implementation plan. Part of this approach is to create forums and initiatives by bringing all of the different skills together to work on the concrete solutions and develop appropriate frameworks for enabling innovation in addressing development and humanitarian risks.

Lack of common approach to data privacy and risk mitigation associated with data use

Privacy and the application of ethical standards for data use must be a top priority for all key stakeholders. Protection of privacy is the key element in making data for social good projects successful. It ensures that Data Users, Data Stewards and Data Providers are accountable in their data practices and that Beneficiaries—most of the time consumers—have trust and faith in the value of their data being used for social good with minimum risks.

17 <https://www.telefonica.com/en/web/public-policy/blog/article/-/blogs/the-6-challenges-of-big-data-for-social-good>.
Accessed March 15, 2017

18 <https://www.gsma.com/newsroom/press-release/gsma-launches-big-data-for-social-good/>

19 <http://www.data4sdgs.org/>

20 <https://digitalimpactalliance.org/>

While the data protection landscape has been shaped for decades²¹, protection of privacy in the world of big data and emerging technologies continues to be one of the most frequently cited challenges to the wider use of mobile network data for social good.

There are various risks linked to privacy that prevent key stakeholders from embracing the value of mobile data for social good. Beneficiaries—typically consumers in the context of this report—may be subject to harms if their identity is exposed—from emotional, physical, economic harms to discrimination and other violations of human rights. MNOs may suffer irreparable reputational, financial and legal harm from real or perceived breaches of confidentiality. Governments or International Organizations may suffer from loss of trust, thereby giving rise to an inability to further implement their mandates in saving or improving human lives, be subject to potential legal proceedings, or contribute to social and political instability, if they misuse citizens' data. Funders and academic institutions would also suffer reputational harm, may be litigated and perhaps lose their ability to operate in a market. In reality, everyone loses if there is an inadvertent or purposeful breach of privacy.

Harms can often be mitigated during the project design phase. However, risks and harms are not absolute and it is necessary to assess the likelihood of each risk and harm as well as the likely magnitude and severity of harms within each specific context. Furthermore, all of the risks and harms must be considered in view of their proportionality to potential benefits as well as likely harms for data non-use²².

With more data being generated today and more ways for it to be used, humanity is mostly challenged by the harms that cannot be predicted at the time of data use.

This precludes many key stakeholders from utilizing data for social good. Understanding the threshold and having clear common guidance on the assessment of risks and harms for data use and non-use is one of the solutions that is being continuously explored by UN Global Pulse²³. The latter approach is being viewed along with and within a general implementation of ethics and human rights into overall risk mitigation, in addition to standard privacy and data protection norms, thus allowing for a much deeper and context specific understanding of risks and harms.

21 UN General Assembly. A/RES/45/95 (1990). Guidelines for the regulation of computerized personal data files. 14 December. Available at <http://www.un.org/documents/ga/res/45/a45r095.htm>

22 UNDG Guidance Note on Big Data for SDGs: Data Privacy, Data Protection and Data Ethics, <https://undg.org/document/undg-guidance-noteon-big-data-for-achievement-of-the-2030-agenda-data-privacy-ethics-and-protection/>

23 United Nations Global Pulse. Risk, Harms, Benefits Assessment Tool, <http://www.unglobalpulse.org/privacy/tools>.

Risks associated with data use, including privacy risks

- › **Re-identification.** Because the patterns of behavior that generate mobile data are often unique to each individual, robust anonymization is difficult. Anonymized and even aggregated data might become re-identifiable when combined with other data sets. Some argue that rigorous anonymization, data coarsening, or noise-adding techniques are not enough to prevent re-identification²⁴. Furthermore, while much of the literature focuses on the risk of individual re-identification, the identification of demographically-related groups of people through less granular data sets can lead to potential harm, particularly should these groups be the target of discriminatory or punitive government policies.
- › **Bias.** Bias may be inherent in mobile data. In some cases, data may not accurately represent a program's target population due to the characteristics of the operator's customer base. It is well documented that there is a gender gap in mobile phone ownership (e.g. due to cultural norms in some countries), and other demographic groups like the young, the elderly, and those living in rural areas may also be under-represented.
- › **Harm.** There are negative consequences that individuals or communities may suffer as a result of the risks inherent in mobile data projects. Many such harms can be caused by certain actors using the data maliciously within a specific context. In this case, factors like politics, economy, cultural and societal norms, and policies need to be taken into account as potential risk factors to assess potential harms. Additionally, harms may be different from one stakeholder to another. For example, loss of reputation, trust, financial loss or legal liability can be caused to those who collected and/or used the data. Emotional, physical or economic harm can be caused to an individual or groups of individuals whose data was used²⁵.

Limits of current regulatory frameworks

Existing regulatory frameworks governing re-use of mobile data are not designed with development and humanitarian applications in mind. Although some regulations may specify exceptions for fast-response humanitarian action, they leave out important opportunities to support development efforts in the lead-up to or in response to such crises²⁶. These gaps prevent MNOs, faced with risks of violating regulatory requirements, from putting their data to work for the social good.

The GSMA published a set of universal Mobile Privacy Principles that describe the way in which mobile consumers' privacy should be respected and protected when consumers use mobile applications and services that access, collect and use personal information²⁷. However, the regulatory environment remains fragmented: with no global framework on data privacy and data protection, stakeholders are often confronted with conflicting laws. Furthermore, there are countries where regulation is unenforced or does not exist, leaving those willing to use the data fearing that it may be misused. The danger in such contexts is that countries at times, due to lack of resources and capacity, copy and paste regulations of other nations into their own without considerations of the unique context, culture or needs of that country. The former and the latter more and more often prevent MNOs from sharing the data with International Organizations in fear of it being compromised, paving the way to the occurrence of likely risks and related harms.

24 Yves-Alexandre de Montjoye, et al. "Privacy-conscientious use of mobile phone data," manuscript yet to be published.

25 United Nations Global Pulse. Risk, Harms, Benefits Assessment Tool, <http://www.unglobalpulse.org/privacy/tools>

26 United Nations Global Pulse. Report on "Big Data for Development and Humanitarian Action: Towards Responsible Governance. Global Pulse Privacy Advisory Group Meetings 2015 – 2016." <http://www.unglobalpulse.org/news/big-data-development-and-humanitarian-action-towards-responsible-governance-report>

27 <https://www.gsma.com/publicpolicy/mobile-privacy-principles>

At the same time, the regulatory community and development and humanitarian organizations are also challenged with the concerns to ensure that the data intended for social good purposes is used for these purposes only. This prevents, particularly the regulators, from moving ahead and approving the passing of the frameworks that are designed to enable data for social good projects. Stronger and more appropriate frameworks need to be developed to address the key issues related to privacy in the context of humanitarian and development efforts.

Ethics and human rights

The right to privacy is a fundamental human right recognized by the Universal Declaration of Human Rights and the International Covenant on Civil and Political Rights. The core principles that ensure protection of the right to privacy have been enshrined in various regulatory frameworks nationally and regionally.

However, with the rise of the interconnected world of technology and data, implementation of existing regulations, as well as the established principles they promote, becomes hard, if not impractical at times. For example, the definition of personal data has been blurred with the use of new technologies that allow for a much easier re-identification. Transparency may become a question of life and death when data processing concerns vulnerable populations or populations at risk of being persecuted if the results of data processing become public knowledge. Privacy may no longer be viewed as a notion that relates to an individual, but relates to groups. This is especially important in humanitarian and development contexts oriented at community level impact. In emergencies, of where the data has been previously pseudonymized, consent may be impossible or impractical to receive. These and many other points provide uncertainty of how the well-defined principles on data privacy are being implemented in today's world and in the contexts of humanitarian and development response.

To ensure that fundamental rights related to mobile data use²⁸ are prioritized, mobile data for social good programs could include considerations of ethics. For example, assessment of risks, harms and benefits of data use and non-use performed by a Data User could be one of the ways to address the less definitive aspects of data privacy principles, especially those that may be beyond the purview of existing legal and regulatory frameworks.

Establishment of ethical, advisory or review boards is another way to approach grey areas that may potentially impact the decision-making process with regard to data use. More and more companies refer to codes of conduct on data ethics in addition to standard privacy compliance mechanisms.

Data security vulnerabilities and data management

Data security presents a challenge to mobile data use when inadequate safeguards lead to a breach, leakage or unauthorized access²⁹. The current state of the Internet of Things and self-improving algorithms provides more and more opportunities for malicious actors to use back doors to manipulate data and systems. At the same time, such interconnected and self-controlling environments leave less space for Data Users, Data Stewards and Data Providers to ensure data security and identify vulnerabilities in time to prevent data breaches. These developments pose more challenges to the ability of MNOs to share data. So far, a number of MNOs have opted to conduct data analytics behind their own firewalls to reduce the risk of data being compromised. International Organizations, at the same time, are looking to ensure secure neutral data storage facilities, often concerned with ways in which data storages can be accessed not only by hackers or compromised by untrained personnel, but also by governments with intentions of using the data for persecution and violation of human rights.

28 A World that Counts: Mobilising the Data Revolution for Sustainable Development, November 2014, page 23.

29 Big Data for Development and Humanitarian Action: Towards Responsible Governance, Global Pulse Advisory Group Meetings, 2015-2016.

Models for Data Access and Management

Current models all use data that has been aggregated, and appropriately anonymized in accordance with local data protection and privacy laws. Examples include:

- › **Sharing databases with end users (a National Statistics Office (NSO), NGO, or other entity) according to rigorous protocols and responsibility agreements.** This model has not gained traction as a long-term sharing solution due to privacy concerns.
- › **Transferring data to a third party responsible for brokering the required compliance and agreements and managing the data.** This model can mitigate concerns about proprietary data being exposed to competitors by designating a trusted party to manage it.
- › **Having the MNO analyze the data in-house, transferring only the insights to the other partners.** This scenario is responsive to data security and privacy concerns and is most likely to satisfy existing privacy rules involving the processing of personal data.

A number of technical solutions exist for ensuring privacy to spur continued innovation, while balancing the protection of privacy and security. For example, Direct or VPN (virtual private network)-based access allows a user to access a copy of the data remotely on a physically secure, monitored, and logged server that is managed by the MNO, so that any attempt to download a copy of the data, execute unauthorized queries or code, or take other actions that could lead to misuse of the data could be rapidly intercepted and recorded as evidence.

Another solution is to develop a platform where certified algorithms are applied to a copy of the data, which stays with the MNO, that is hosted by the MNO within its secure network, to produce a set of distinct insights—without ever granting a third party access to the data directly. The Global Partnership for Sustainable Development Data (GPSDD) is currently testing the solution through a project known as the “Open Algorithms Project” (OPAL)³⁰.

Lack of technical capacity globally and in LMICs

The mobile data for social good field faces some unique challenges when it comes to the capacity of key stakeholders. Whereas traditional development projects may involve a set of stakeholders with common, well-entrenched skill sets, using mobile data for development or humanitarian purposes requires unique technical skills and expertise that in some cases may be lacking.

We should insert big data and what it can tell us into existing forums—don't set up new forums or ventures—so there is locally more interest. The use of big data needs to take root locally. The work the global guys do is good, but we need to find mechanisms for these things to happen locally and to build that local capacity.

—Thavisha Gomez, Research Manager, Big Data, LIRNEasia

The demand for data scientists globally outstrips the supply, particularly in low-resource settings³¹. Large, international MNOs often have research laboratories developing the methods and tools to gain further insights from mobile data. Small MNOs that operate in only one country do not have this capacity in house and may not have the same ability to partner with external groups. Traditional development organizations, governments, and NGOs lack specialized staff with enough technical skills—both data scientists and data managers—to extract value and insights from mobile data using or commissioning sophisticated methods and tools.

30 <http://www.opalproject.org/>

31 Big Data Big Impact, New Possibilities for International Development, page 6.

Furthermore, there are few translators to close the gap between the technologists and policymakers, and the asymmetry of knowledge contributes to the impasse in the field.

There are multiple challenges to using mobile data for social good, but they are solvable given the right alignment and incentives. There must be, a compelling value proposition for each stakeholder to want to invest the time, energy and money into creating a solution. Capacities must be built globally to prevent a new divide. Until this is achieved, the use of mobile data for social good will remain an interesting yet unfulfilled possibility for years longer than it need be, all the while incurring a heavy opportunity cost in development progress and human lives.

RECOMMENDATIONS

This section addresses the need for evidence to spur investment and use, cohesion of effort, privacy and data protection, and technical capacity.

Identify and build sustainable business models

Analyze pilot project business models to understand which projects have demonstrated return on investment and which have not.

Most big data for social good activities of operators are currently performed as data philanthropy... this is usually for pilots or research, requiring little effort and investment from operators... This is not a sustainable model when we move from “one-offs” to systems in operation with daily data feeds. I am convinced the ecosystem will understand that systems in operation, also for social good, have a cost. Moreover, governments and humanitarian agencies are currently spending budget on monitoring and achieving the SDGs, and... budget will be re-allocated from old processes to digital ones. Finally, think about how “green” and “sustainable/fair supply chains” started: some companies were leading in showing the world that it was important to respect the environment and the situation of workers far away. Now “green” and “fair supply chains” are a business must. The same will happen with big data for social good. So companies that today invest in this area, will be the leaders in the future.

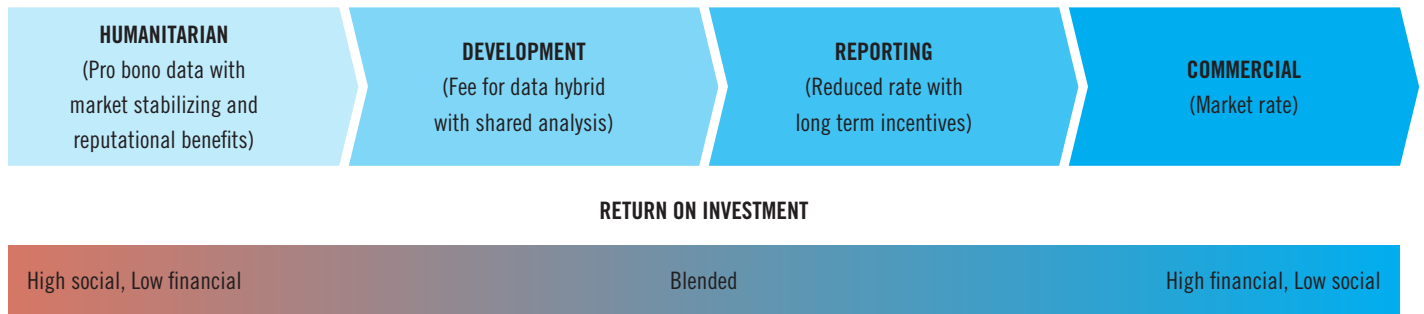
—Richard Benjamins, Director of External Positioning & Big Data for Social Good at LUCA, Telefonica Data Unit

Increasingly, development projects need to be considered along a continuum that includes commercial application of related activities (see Figure 1). There are humanitarian scenarios in which the social imperative for sharing mobile data is so critical that efforts should be prioritized so that Data Providers are empowered to analyse and share insights in responsible ways to enable informed decisions that can save lives. As projects advance further along the continuum to commercial activity, there may be hybrid scenarios where financial compensation is combined with compelling market insights, reputational advantages and social impact.

Additionally, it might possible to consider stage-based business relationships between the private sector and governments or ministries where data is shared at no cost for purposes of research and program development, with the explicit agreement that this upfront investment will lead to long-term relationships between these parties and with the opportunity to mutually develop new revenue streams, particularly as the relationship exposes novel uses for the data.

The provisioning of upfront capital by the donor community can fill a current gap in the resources required to finance implementations with the greatest social imperative, and to catalyze new business models. In addition to ensuring that development and humanitarian projects get off the ground in a timely fashion, this kind of investment will help to test the incentives and build the models that will ensure longer-term sustainability.

Figure 1. Business Models Depend on the Social Application of the Data



Address gaps within the data privacy and data protection landscape and mitigate risks

Taking a risk-utility approach and conducting a detailed **risks, harms and benefits assessment** provides the following benefits:

- › A risk-utility approach allows stakeholders to understand what level of aggregation is appropriate for a particular data for social good use. This is typically done by comparing the utility of the aggregated data with the risk of re-identification. This approach helps identify scenarios where the potential utility of data use is highest and the risk of re-identification is lowest.
- › The assessment of risks, harms and benefits would include the cultural, religious, social, political, and legal circumstances of a project, allowing for a more context specific assessment of proportionality of the risks and harms to the benefits.
- › The assessment also serves as a logical and compelling rationale for assuming risks, harms and benefits inherent to a project³² and would be included in project documentation as part of an accountability process. The assessment can help identify and evaluate the risks, harms, and benefits and then compare potential harms to anticipated public benefits.
- › The results should be used to mitigate any potential risks, prevent harms and design a mobile data for social good project with minimum negative impacts and maximized benefits to the data beneficiaries. The assessment can also serve as a communications tool to key stakeholders, including the general public, bringing awareness of the benefits of the project and steps taken to address and mitigate risks.

Invest in innovation projects on privacy and security engineering to develop new models for mitigating re-identification risks and addressing data breaches. This effort should be supported by establishing legitimate guidelines on the acceptable risk threshold for re-identification. For example, the self-regulatory guidelines could be developed by private sector, through consultations with other relevant stakeholders, including data (technical) experts, data privacy experts and humanitarian and development practitioners.

Active participation of data advocates is another ingredient in a successful approach to managing data related risks. These are people or organizations who understand the risks, the complexity of the regulatory environment, and who embrace the great potential of the data. They can speak with confidence about the legitimate and appropriate application of this information and could be trusted by the key stakeholders, including, operators, to do so. Furthermore, sophisticated communication techniques from sources trusted by the public should be employed to avoid even the perception that data privacy will not be protected. Education and involvement of policy makers and the media will be critical.

32 Mapping the Risk-Utility Landscape of Mobile Data for Sustainable Development & Humanitarian Action, UN Global Pulse and Massachusetts Institute of Technology, 2015, page 3.

Collegial engagement and dialogue of data users, data providers and privacy advocates is key to achieving tangible outcomes and making data for social good operational. This means that conversations held by stakeholders from MNOs, regulatory community, data experts (those who work with data) and humanitarian and development actors should happen in the same room. All stakeholders, from the ones who understand the value of the data, to those who vouched to protect privacy to those whose main objective is to protect their business need to work together to develop actionable solutions. Data Providers and Data Users can also lead the way in the setup and use of data handling frameworks that are responsive to the characteristics and capacity of the partners, the intended use of the data, and the risks presented by non-use.

Revise current regulatory frameworks or develop new ones to address development and humanitarian challenges. As a first step, the data for social good community can develop best practices and guidelines to address issues specific to humanitarian response or development action (e.g., GSMA's guidelines for the Ebola outbreak)³³. A recent example of the regulatory community taking stand on the issue of privacy and humanitarian action is passing of the ICDPPC Resolution on Privacy and International Humanitarian Action³⁴, encouraging national laws to adopt a similar approach to privacy in the context of humanitarian response and paving the way to a possible enforceable legal regulatory instrument on the issue in the future. Such frameworks should guarantee that the data approved for development and humanitarian causes cannot be re-used or repurposed, thus guaranteeing accountability of all stakeholders. Once such frameworks are developed, they would allow for a compliant and smooth process of data for social good, building trust among stakeholders.

Create a template for legal agreements between the Data Users and MNOs on how data should be accessed and handled, transferred or otherwise used. When possible, these standard templates should have the review and approval of legislators and be established well in advance of program design (process similar to the Standard Contractual Clauses—sets of contract clauses that were issued by the European Commission pursuant to Article 26(2) of EU Data Protection Directive 95/46/EC).

Additionally, a possible solution to enable the use of data for social good could be **subscribers' opt-in** to have their mobile data used for social good research and projects.

33 GSMA Guidelines on the protection of privacy in the use of mobile phone data for responding to the Ebola outbreak, October 2014.

34 International Conference of Data Protection and Privacy Commissioners, Resolution on Data Protection and International Organizations, available at <https://icdppc.org/document-archive/adopted-resolutions/>

Build capacity in the right places

Mobile data analytics requires unique skills and expertise that are in short supply. Moreover, there are few manager profiles able to close the knowledge gap between the technical experts and decision makers in the development and humanitarian communities.

Develop local technology capacity and engagement with local experts. The maximum utility of mobile data is only fully realized when it is combined with local context knowledge and other datasets that often only NSOs and local government bodies have access to. Experts with contextual expertise bring critical focus to project design. Building local technical capacity through training and curricula has potential for significant impact with nominal additional investment.

While on a case-by-case basis there may be individual data advocates within a given PPP, the **stakeholders consortium as a whole needs to be engaged** to support the mobile data for social good sector. There is a clear need for passionate “data evangelists” to better communicate how mobile data can be used to benefit the interests of all relevant stakeholders. There is also a role for this community in defining and driving the regulation conversation in support of legislation that does not unnecessarily stifle the field. This need exists at the international and country level and the target audiences would range from the ministerial level to the general public.

The cultivation of Data Stewards who can reliably speak on behalf of all key stakeholders and who are trusted by partners to drive the most complex features of the project would also fill a current ecosystem gap.

Improved coordination among countries to enable learning from best practices and to create cohesive strategies for working with multinational operators would promote international learning and help bridge capacity gaps. Mobile data for social good will benefit from cultivating regional or cross-regional groupings of country leaders and technical and sectoral experts to advance this coordination and capture key lessons learned through in-person convenings.

The introduction of big data into existing development and humanitarian sector learning networks could promote understanding of big data uses and methodologies in these communities of practice and minimize duplication of efforts. It is critical that domain experts understand which are the problems that can and cannot be addressed with mobile data analytics. Structured conversations that include key stakeholders, including regulatory bodies and government, that are focused on specific challenges and result in scalable program design, will accelerate this evolution. Special efforts should be made in less developed countries and the Global South. Knowledge products and resources such as the UN Global Pulse and UNDP “*Guide to Data Innovation for Development – From idea to proof-of-concept,*” can be used to help introduce the concept to development practitioners.³⁵

Mainstreaming of the application of mobile data for development would embed the field in traditional development conversations and convenings, as opposed to remaining in a data silo or with an innovation etiquette.

Create global tools for public good

Creating adaptable platforms addresses the need for a software architecture that is use case- and country-agnostic but can be adapted to particular scenarios. Generic, componentized and modular software designed to combine public and private data for processing and analysis could be created to support the exchange of mobile data between Data Providers and Data Users. This would also eliminate some of the friction and inefficiency that result from ad hoc data requests. Such a platform should build on and integrate with existing efforts to create open-source platforms and algorithms like OPAL, an initiative to reduce the impediments to MNO participation by enabling the analysis to be run behind the operator’s own firewall.

35 <http://unglobalpulse.org/news/guide-to-designing-data-innovation-projects>

Develop an open-source data handling toolkit that includes specifications for standard data sets that the development community has agreed are useful for a range of given challenges, as well as open algorithms that support social good but also generate important business insights, and scripts that enable the MNO to run the analysis in house. This toolkit could be brought into the data center of a partner MNO and result in data extraction using a mutually agreed upon methodology.

Generating a decision tree to understand whether mobile data analysis is an appropriate solution to a particular problem statement. The decision tree would help Data Users capture the potential benefits, challenges and risks of given mobile data applications (as part of project scoping documentation).

A cost-benefit analysis tool could be used to understand how much a given mobile data for development application will cost, and who will bear those costs. It should include financial and other resources, as well as unintended costs/consequences. This tool could reassure reluctant stakeholders.

PROPOSED MILESTONES FOR 2018

Design and Conduct an Impact Demonstration Project

Those who need data and those who supply data must fully understand the value proposition of mobile data for social impact. An abundance of research and feasibility studies have demonstrated that the field is ready to move beyond the short-term and ad hoc approach to more systematic, scalable, replicable, and sustainable implementations.

Experts agree that the time is now to gather key international leaders, government officials, and donors to back an implementation roadmap with both near-term goals and a clear vision for utilizing mobile data for social good. Small studies have less risk and are easier to do, but only with large demonstration projects can the full impact and value of the immense volume of mobile data produced every day be understood by all actors in this field.

The experts consulted for this report were clear that holding one more meeting to “discuss” mobile data is not an adequate call to action. What is needed is a commitment of key stakeholders, backed by funding and resources from donors, to design, plan and implement an impact demonstration project that will decisively establish the value of mobile data for social good.

While the potential is clear, the success of the thousands of projects that have sprung up using technology to close access gaps is less so. Pilots have failed to move into scalable and sustainable programs. Solutions too often reinvent the wheel rather than building on robust platforms, infrastructure, and shared services. Applications and services designed thousands of miles from their use environment fail to meet user needs. The creation of duplicative tools and systems has made data difficult to access and use for decision-making. This is an inefficient use of scarce resources. We must do better, both to fulfill our own mandates and, critically, to deliver to the best of our ability for the people we serve.

—Principles for Digital Development³⁶

Impact demonstration projects are carefully crafted collaborations designed and implemented to address a specific challenge and lay the ground for future incremental advances. The demonstration project’s activities must be replicable for use in other areas, and assessment metrics are proactively established and monitored throughout. The link between use of mobile data and longer-term social impact would be the project’s aim. It is expected to produce much more evidence to link activities to insights, insights to action, and action to impact.

The steps to get there include buy-in and support from key development and humanitarian leaders, a technology roadmap development process, and a multi-sector steering committee to help overcome barriers and maintain focus. Importantly, donor funding for an effort of this size and complexity will be needed to ensure the demonstration project is designed in a manner that allows for conclusive results, as well as capturing all relevant knowledge gained during implementation in order to inform future efforts.

36 <http://digitalprinciples.org/>. Accessed May 7, 2017

Step 1: Bring key leaders from the involved sectors together to align around a vision

Several facets of humanitarian and development work could benefit from the insights derived from mobile data. Humanitarian crisis response, health, agriculture, economic development, transportation, and governance programs are mostly informed and managed using traditional data sources. However, these sources have inherent weaknesses. Information is often lacking in timeliness, quality and accuracy, and by the time problems are discovered, the damage has already been done. For those committed to evidence-based decision-making, particularly in today's fast-changing connected world, relying solely on traditional data sources—and the outmoded linear organizational processes they support—is no longer sufficient.

A high-level convening of senior government officials, donors, IO and NGO leaders, and MNO executives would present an opportunity to align key actors around a common vision for further use of and investments in mobile data. This vision, with backing from key stakeholders, would drive the next step of building an implementation roadmap.

My recommendation is for us to try and elevate the conversation. The field of mobile data/big data for development is part of a larger move to problem solving across domains that is becoming increasingly data- and analytics-driven. So, the improvements in mobile data for development will accompany bigger shifts in discovery, analysis and decision-making that are going to use big data as an intrinsic property. Therefore, this requires greater collaboration among private and public sectors and academia as we are pushing the entire field of enquiry forward. More importantly, it calls for more thoughtfulness and better judgment in the field of social impact as we shift the predictive and optimization aspect of development problems to algorithms and data.

—Syed Reza, Senior Director, Digital Impact Alliance

Step 2: Build a community-driven roadmap for the impact demonstration project

Each stakeholder must be engaged in the design and development of the impact demonstration project in order to ensure their specific information and evidence needs are fulfilled. An innovative tool for guiding a community through this process is a Technology Roadmap. The roadmap would provide a longer-term plan under which the demonstration project, as well as smaller projects and activities aimed at removing key barriers, could align.

Potential Model: Malaria Vaccine Technology Roadmap

The Malaria Vaccine Funders Group is an informal consortium of some of the key funders of malaria vaccine development. In 2004-2006, they commissioned a “Malaria Vaccine Technology Roadmap” led by the World Health Organization. The roadmap’s purpose was to align the actions and investments of the broader community around a common vision and strategic goals. More than 100 individuals from the public and private sectors participated in the stakeholder meetings and contributed to the creation of the roadmap. The roadmap has successfully served as the guide for funding and collaboration in the field, highlighting issues that were not being addressed and reducing duplication of efforts. The roadmap was updated in 2013 to change the community’s direction due to the success of other interventions that halved worldwide deaths from malaria.

Vision: Safe and effective vaccines against *Plasmodium falciparum* and *Plasmodium vivax* that prevent transmission, disease and death to enable malaria eradication.

Strategic Goals: By 2030, licensed vaccines targeting *Plasmodium falciparum* and *Plasmodium vivax* and encompassing the following two objectives, for use by the international public health community:

- › Malaria vaccines with a protective efficacy of at least 70–80% against clinical malaria, suitable for administration to appropriate at-risk groups in malaria-endemic areas.
- › Malaria vaccines that reduce transmission of the parasite and thereby substantially reduce the incidence of human malaria infection to achieve elimination in multiple settings. The vaccines should be suitable for administration to people of all ages in mass campaigns.

A technology roadmap would identify the major components of an impact demonstration project and the key policy, regulatory, technical, and capacity issues that need to be addressed for success. The factors important to a demonstration project, gleaned from expert interviews and a review of the literature, include:

- › Clear humanitarian or development use case demonstrating value for the public good, with a way to assess the opportunity cost of non-intervention. (The most rigorous method would be randomized control trials.)
- › Plan and agree on how privacy and regulatory concerns will be addressed.
- › Plan for access to the appropriate data, either real-time or for the longer-term. This includes the non-mobile data sets that are critical for generating meaning of the data.
- › Documentation of the scripts and algorithms used on data sets to generate insights.
- › Rigorous monitoring and evaluation with a built-in impact evaluation.
- › Project leadership from key stakeholders in the public sector and MNOs.
- › Strong relationships with key ministry leadership, as a demonstration project could span several sectors in one country or could span several countries in one sector.
- › Plan for scale built into the demonstration project design. This may include initial up-front donor funding and a proposed business model to apply once scale is achieved.
- › Significant and dedicated funding support for the project over several years.
- › Detailed account of challenges encountered during implementation and how they were addressed
- › Strong communications plan.

The availability of even one robust case that has documented the above is widely believed to be an important accelerant to the mobile data for social good field. A replicable model would give confidence to other stakeholders to apply mobile data to new challenges.

Step 3: Secure catalytic funding for roadmap activities

The donor community will need to lead the creation of the demonstration project and ensure that the project objectives provide the evidence base for the meaningful impact of mobile data. A significant investment will be needed to catalyze the use of mobile data for social good at scale. A small group of like-minded donors could fund and oversee the demonstration project, which would pave the way for scaling and systematizing the use of mobile data to achieve program objectives.

In the long term, viable business models must be developed to support the sustainable, market-driven use of mobile data for social good. Experimentation on those models will be explored in the course of the demonstration project.

The one and only condition for a successful partnership is that all the players realize that the only way to success is genuine collaboration—a collaboration where each partner contributes with their domain expertise, and respects the other partners for theirs. No one partner can do everything on their own.

—Kent Engø-Monsen, Senior Research Scientist, Telenor

Step 4: Create a public-private partnership to oversee the demonstration project

An operational mechanism is needed to hold the project’s vision, and rapidly execute on the roadmap plan while ensuring the ongoing involvement of multiple stakeholders and implementers. Public-private partnerships have been created in many sectors to provide collaborative and effective operational leadership. Figure 1, describes a possible organizational structure for a partnership.

Figure 2. Primary Roles within a Partnership for a Mobile Data for Social Good Project



As illustrated in Figure 2, a public-private partnership to manage a mobile data demonstration project could have the following structure:

- › **Donor-led Steering Committee.** Donors are critical to tipping the balance toward fully understanding the value proposition of mobile data for social good. They would provide the bulk of the funding for the demonstration project. They would also guide and review the work to ensure the project achieves its desired outcomes.
- › **Data Beneficiary.** Whether the general public, a target population, or a government, the needs and circumstances of this group must define the demonstration project's challenge statement. Representation on the Steering Committee would provide a mechanism for input and review. Even if they are not the primary beneficiary, governments have a role to play in clearing policy and regulatory hurdles. They must also agree to thorough transparency, as the process and outcomes will need to be well documented and evaluated so they can be used in other countries.
- › **Data Steward.** This role is typically performed by an International Organization, research institution or NGO. The Data Steward provides operational management of the demonstration project, and mediates the complex interests of various stakeholders. They receive donor funds and make grants and contracts to conduct the demonstration project. Strategic external and internal communication is a key responsibility, as is creating reusable assets. This entity would likely also play the role of Data Translator.
- › **Data Provider.** MNOs would provide the mobile data and have input into the design and development of the demonstration project. Strong leadership and backing at the headquarters and country level are essential, as participating in an impact demonstration project comes with risks for the companies. The participating MNO(s) must be willing to embark on the project in good faith, working closely with other members of the partnership. Recently, GSMA launched the Big Data for Social Good initiative along with 16 of the world's leading mobile operators, who collectively account for over 2 billion connections across more than 100 countries³⁷. This Initiative bodes well for the type of collaboration that will be needed for the impact demonstration project.
- › **Data User.** International and country-level researchers with data science expertise, as well as researchers with specific domain knowledge, would play a role in the design of the demonstration project and its execution. They will be needed to create algorithms, support policy development around regulations and privacy protection, and conduct a rigorous, independent impact evaluation. These are the same individuals and organizations that have been driving the pilot and feasibility studies, and they are eager to see the field of mobile data for social good go to scale and demonstrate impact.

In addition to the structure of the managing partnership, important consideration should be given to the country (or countries) that serve as the site for the demonstration project. The selected countries will have high-level political leadership that publicly supports the demonstration project, ensure intra-governmental cooperation, and work well with participating MNOs³⁸. The countries should also be willing to examine laws and regulations that could impede progress of the demonstration project. In return, selected countries would benefit from the insights generated by the project, and grow their capacity for using mobile data. Building capacity can be an explicit part of the demonstration project design, which will enhance the long-term sustainability of any future mobile data for social good projects.

An example of a country acting as a demonstration project for scaling interventions is Zambia, which has strongly supported malaria control programs.

37 February 26, 2017 Press Release. Accessed April 16, 2017 <http://www.gsma.com/newsroom/press-release/gsma-launches-big-data-for-social-good/>

38 Broadband Commission for Sustainable Development. February 2017. Digital Health: A Call for Government Leadership and Cooperation between ICT and Health. Accessed April 15, 2017 <http://www.broadbandcommission.org/Documents/publications/WorkingGroupHealthReport-2017.pdf>

Demonstration Country Example: Zambia's Malaria Control Program

In 2005, the Bill & Melinda Gates Foundation and the NGO PATH formed the Malaria Control and Elimination Partnership (MACEPA) to bring to national scale malaria interventions such as bed nets, treatment, and spraying to disrupt the mosquito vector. Zambia was chosen as the first demonstration country.

From the start, a committed government drove the program. A senior Ministry of Health official attributed the success to strong internal leadership, beginning with ministry staff and the ministerial task force who were swift to initiate central and district-level action such as expanded grants to districts and the elimination of taxes on malaria control tools. In a public show of support, President Rupia Banda donned malaria control T-shirts when appearing in public, had his own house sprayed, and made a high-profile request to accelerate bednet distribution.

—Millions Saved: New Cases of Proven Success in Global Health

Zambia changed national policies, changed regulations to remove taxes and tariffs on malaria commodities, and increased budgets. They worked in partnership with the private sector and emphasized monitoring and evaluation from the start. Malaria deaths decreased by 66% during the time of the demonstration project.

This demonstration project will provide the evidence that mobile data can be used to increase the impact of large-scale programs and to move the entire field forward to sustainability and scale. An additional outcome will be to systematically develop and document solutions to the key policy, regulatory, and operational barriers identified in the challenges section of this paper. Currently, each pilot project finds solutions to the barriers it faces, such as one-off data access agreements that provide for subscriber privacy within the existing regulatory frameworks. While this approach works well in the innovation stage, this ad-hoc solution is an inefficient way to achieve scale. For each challenge, the stakeholders would be convened to create tested and documented solutions, for which tools and methods would be codified for replicability.

CONCLUSION

The use of anonymized and aggregated to appropriate levels mobile data for social good is at an inflection point. **With an abundance of research and pilot studies that have demonstrated proof of concept, the field is now poised to move beyond short-term and ad hoc projects to more systematic and institutionalized implementations.**

These implementations will focus on impact and will be scalable, replicable, and sustainable. Their utility and benefit to human well-being will be understood and documented, and they will be driven by compelling use cases and, eventually, market forces.

Efforts to date have been driven by “true believers,” technologists, and researchers, who have conducted pilot and feasibility projects that have proven concepts but not impact. The collective results have not yet provided the evidence that governments, donors, and international organizations require to adopt mobile data insights as a robust source of data with which to make program decisions and track progress. The lack of adoption of mobile data insights by development policymakers is a key impediment to scaling the use of mobile data.

An impact demonstration project designed with key stakeholders may provide the evidence needed to tip the balance toward the use of mobile data. A clear demand for the insights mobile data can offer will provide the impetus to overcome barriers ranging from the creation of standard algorithms to the protection of consumer privacy. **A shift in the field must involve both demand- and supply-side decision makers to drive the efforts to scale.**

Data from nearly five billion unique mobile subscribers and eight billion mobile connections are housed in the data systems of MNOs. Using that data to improve the well being of communities requires a concerted effort by all stakeholders to meet the prevailing development and humanitarian needs of communities and reassure all parties that the benefits to society outweigh the risks.

ANNOTATED BIBLIOGRAPHY

- ▶ Agüero, Aileen, Harsha de Silva and Juhee Kang. “Bottom of the Pyramid Expenditure Patterns on Mobile Services in Selected Asian Countries” *Information Technologies & International Development* 7(3): 19-32, 2011. <http://itidjournal.org/itid/article/viewFile/758/318>
This article analyzes mobile phone expenditure patterns for people at the bottom of the pyramid (BoP) in six Asian countries. It concludes that mobile phone services are necessities at the BoP, not a luxury.
- ▶ “Big Data for Development: Risks and Opportunities.” Video of panel at the Internet Governance Forum, Brasil, 2015. https://www.youtube.com/watch?v=2N_49mUpu-U
This panel discussion dealt with data protection and privacy in big data analysis. Panelists were asked to offer suggestions for how to reduce risks. A report on this panel is available at <http://www.intgovforum.org/cms/workshops/list-of-published-workshop-proposals>.
- ▶ Bogomolov, Andrey, Bruno Lepri, Jacopo Staiano, Nuria Oliver, Fabio Pianesi, and Alex Pentland. “Once Upon a Crime: Towards Crime Prediction from Demographics and Mobile Data.” Accessed February 6, 2017. <https://arxiv.org/pdf/1409.2983v1.pdf>
This paper looks at the use of mobile phone and demographic data for crime analysis. Researchers had an accuracy of almost 70% when predicting London crime hotspots.
- ▶ “Breakthrough Business Models: Exponentially More Social, Lean, Integrated and Circular.” *Volans.com*. September 2016. http://volans.com/wp-content/uploads/2016/09/Volans_Breakthrough-Business-Models_Report_Sep2016.pdf
This report looks at sustainability and the fact that it needs to move from corporate social responsibility to a driver for how business is done.
- ▶ Britto, Neil, David Sangokoya, Iryna Sussha, Stefaan Verhulst and Andrew Young. “The GovLab Selected Readings on Data Collaboratives (Updated and Expanded).” *GOVLab*. June 10, 2016. <http://thegovlab.org/the-govlab-selected-readings-on-data-collaboratives/>
This GovLab Selected Readings series provides an extensive annotated and curated collection of recommended literature on data collaboratives.
- ▶ Broderick, Florence. “Nicolas de Cordes: “It’s time to scale up Big Data for Social Good.”” Luca: Data driven decisions 10 January 2017. http://data-speaks.luca-d3.com/2017/01/nicolas-de-cordes-its-time-to-scale-up_10.html
In this interview, de Cordes talks about his experiences in using big data for social good, and his view on upcoming opportunities in this sector.
- ▶ Buckee, Caroline O., and Kenth Engø-Monsen. “Mobile phone data for public health: towards data-sharing solutions that protect individual privacy and national security.” Telenor Report R 2 / 2016. <https://arxiv.org/abs/1606.00864>
This report looks at issues faced by operators who share anonymized data with researchers or policymakers, and proposes a conservative way of sharing call data record data for infectious disease epidemiology that prevents the identification of individuals. The authors view the approach as a useful model for partnerships between mobile operators, researchers and public health practitioners. The report provides a useful discussion around the mechanics of public-private partnerships that do this work.
- ▶ “Case Study: Haiti Cholera Outbreak 2010.” *Flowminder.org*. Accessed February 6, 2017. <http://www.flowminder.org/case-studies/haiti-cholera-outbreak-2010>
This case study explains how mobile phone data was used to predict people’s movement following a cholera outbreak in Haiti, and how this novel methodology was subsequently tested for accuracy. It was found that mobile phone mobility patterns enabled prediction of the cholera spread, which was

better than standard models for population movement (that modelers have to use if real-life data on movements are lacking).

- › “Catching swine flu: how big data helped doctors to understand a pandemic.” Accessed February 6, 2017. http://static.o2.co.uk/www/docs/business/ourthoughts/vr2_o2_swine_flu_case_study_pdf.pdf
This piece describes how Telefonica was able to use mobile phone data to analyze the efficacy of Mexican government measures to limit people’s movement in an effort to curb the spread of swine flu.
- › de Montjoye, Yves-Alexandre, Jake Kendall, and Cameron F. Kerry. “Enabling Humanitarian Use of Mobile Phone Data.” *Issues in Technology Innovation*. Brookings Institution, November 2014. <https://www.brookings.edu/wp-content/uploads/2016/06/BrookingsTechMobilePhoneDataWeb.pdf>
This paper discusses leveraging the benefits of mobile phone data for humanitarian use while minimizing risks to privacy.
- › de Montejoye, Y., V. Blondel, G. Canright, N. de Cordes, S. Deletaille, K. Engo-Monsen, S. Gambis, M. Garcia-Herranz, J. Kendall, C. Kerry, G. Krings, M. Luengo-Oroz, N. Oliver, A. Rutherford, Z. Smoreda, E. Wetter, A. Pentland, L. Bengtsson. “Privacy-conscientious Use of Mobile Phone Data.” Unpublished paper accessed February 6, 2107. http://openscholar.mit.edu/sites/default/files/bigdataworkshops/files/draft_modelsformobilephonedatasharing.pdf
This paper proposes four models and a general framework for use of mobile phone data with proper consideration of privacy concerns, and discusses pros and cons of each.
- › GSMA. “Discussing ‘Data for Development’ “, August 23, 2016. <http://www.gsma.com/mobilefordevelopment/Program/digital-identity/discussing-data-for-development>
Summary of a panel discussion held at GSMA’s Mobile 360 Africa Conference in Dar es Salaam, with Nicolas de Cordes from Orange Group, Eric Anderson from the World Bank, and John Quinn from UN Global Pulse. They highlighted actual and emerging use cases, and important challenges arising from the use of mobile-derived big data for public policy and development projects. Particular challenges included: An asymmetry between the supply and demand for big data; ministries’ lack of capacity; the development community’s lack of capacity around asking for data; and lengthy negotiations between MNOs and other institutions.
- › GSMA. “Mobile Policy Handbook: An Insider’s Guide to the Issues.” Accessed February 6, 2017. <http://www.gsma.com/publicpolicy/handbook/search-results>
The Mobile Policy Handbook aims to support governments and regulators in their efforts to introduce pro-investment telecommunications policies. It proposes an industry position on big data, especially in relation to privacy.
- › GSMA. “GSMA Guidelines on the Protection of Privacy in the Use of Mobile Phone Data for Responding to the Ebola Outbreak.” October 2014. <http://www.gsma.com/mobilefordevelopment/country/global/gsma-guidelines-on-the-protection-of-privacy-in-the-use-of-mobile-phone-data-for-responding-to-the-ebola-outbreak>
These guidelines propose broad-outline privacy standards that mobile operators should apply when sharing call data records (CDRs) in response to the Ebola outbreak.
- › Gupta, Nirant, Jake Kendall. “Big Data and How It Can Serve Development.” July 02, 2014. <http://www.impatientoptimists.org/Posts/2014/07/Big-Data-and-How-it-Can-Serve-Development#V4TvY9ekXwQ>
This piece discusses the potential use of big data to improve the lives of the poor in developing countries. The report ‘Using Mobile Data for Development’ is linked from this page.
- › Harvard Business Review Staff. “With Big Data Comes Big Responsibility.” *Harvard Business Review*, November 2014. <https://hbr.org/2014/11/with-big-data-comes-big-responsibility>

This is an interview with Alex Pentland about the issue of data ownership, and his proposal for a New Deal on Data.

- › Hwang Chang-Gyu. Speech at UN Global Compact: “Join hands with the UN to prevent the spread of global diseases.” Accessed February 6, 2017. <http://www.prnewswire.com/news-releases/kt-ceo-hwang-chang-gyu-delivers-speech-at-un-global-compact-join-hands-with-the-un-to-prevent-the-spread-of-global-diseases-300290512.html>
This press release summarizes Hwang’s speech, in which he inter alia described Korea Telecom’s efforts in big data for social good.
- › International Conference of Data Protection and Privacy Commissioners, Resolution on Data Protection and International Organizations, available at <https://icdppc.org/document-archive/adopted-resolutions>.
This page contains relevant information on all International Conferences.
- › Kreindler, Gabriel, Sriganesh Lokanathan. “Challenges of working with mobile network big data.” Presentation at the Big data for development: Responsible use of mobile meta-data to support public purposes LIRNEasia event, Negombo, Sri Lanka, August 2014. <http://lirneasia.net/wp-content/uploads/2014/08/methodChallenges.pdf>
This presentation shows challenges inherent in the nature of mobile data, and the need to compensate for sample selection bias.
- › Lee, Panthea. “#LongReads: Moving from Real-Time Data to Real-Time Programs.” October 12, 2016. <http://reboot.org/2016/10/12/longreads-moving-real-time-data-real-time-programs/>
This article discusses the quantities of data being produced in the modern world, and the fact that more data does not necessarily lead to better decisions.
- › Letouzé, Emmanuel, and Patrick Vinck. “The Law, Politics and Ethics of Cell Phone Data Analytics.” DataPop white paper. April 2015. <http://datapopalliance.org/item/white-paper-the-law-politics-and-ethics-of-cell-phone-data-analytics/>
This white paper looks at call data records (CDRs) and current related legal frameworks that affect the sharing of CDRs, before exploring structural socio-political parameters and incentives that influence this. It proposes ethical principles to guide CDR sharing, and discusses operational options and requirements.
- › Maldeniya, Danaja. “Leveraging Mobile Network Big Data for Transport Planning.” Presentation at the Big data for development: Responsible use of mobile meta-data to support public purposes LIRNEasia event, Negombo, Sri Lanka, August 2014. <http://lirneasia.net/wp-content/uploads/2014/08/transportPlanning.pdf>
This presentation shows how mobile (GPRS and SMS) data was used to better understand commuter trips in Colombo, Sri Lanka, and transport corridors.
- › Naboulsi, Diala, and Marco Fiore, Stephane Ribot, Razvan Stanica. “Large-scale Mobile Traffic Analysis: A Survey”, IEEE Communications Society, Institute of Electrical and Electronics Engineers, 2016, 18 (1), pp.124-161. <https://hal.inria.fr/hal-01132385/document>
This article is a survey of mobile traffic analyses collected by network operators. It proposes major categories and subcategories for these analyses, and examines the literature in these categories. The paper provides a summary of the current main findings, and points to potential research areas.
- › Naef, Ed, and Philipp Muelbert, Syed Raza, Raquel Frederick, Jake Kendall, and Nirant Gupta. “Using Mobile Data for Development.” May 2014. <https://docs.gatesfoundation.org/Documents/Using%20Mobile%20Data%20for%20Development.pdf>
This report covers: What data is captured by mobile data systems; existing and possible uses of that data; the regulatory landscape; and considerations for data sharing, especially privacy.

- › Noveck, Beth Simone. “Data Collaboratives: Sharing Public Data in Private Hands for Social Good.” *Forbes.com*. September 24, 2015. <http://www.forbes.com/sites/bethsimonenoveck/2015/09/24/private-data-sharing-for-public-good/#6253d9b965bb>
This piece argues for the power of sharing of data, particularly private data.
- › Oldgard, Mai. “Defeating epidemic disease with Big Data.” 9 September 2015. <http://www.telenor.com/media/articles/2015/defeating-epidemic-disease-with-big-data/>
Editorial piece about the study “Impacts of human mobility on the emergence of dengue epidemics in Pakistan,” as well as population displacements.
- › “Orange Data for Development Challenge in Senegal”, *Challenge 4 development*. Accessed February 6, 2017. http://d4d.orange.com/content/download/43330/405662/version/3/file/D4Dchallenge_leaflet_A4_V2Eweblite.pdf
This piece describes the background to the Development Challenge, and the winners.
- › Pastor-Escuredo, David, Morales-Guzmán, Alfredo, Torres-Fernández, Yolanda, Bauer, Jean-Martin, Wadhwa, Amit, Castro-Correa, Carlos, Romanoff, Liudmyla, Lee, Jong Gun, Rutherford, Alex, Frias-Martinez, Vanessa, Oliver, Nuria, Frias-Martinez, Enrique, and Miguel Luengo-Oroz. “Flooding through the Lens of Mobile Phone Activity.” Paper submitted to the IEEE Global Humanitarian Technology Conference, 2014. <http://bit.ly/1OzK2bK>
This report describes the impact of using mobile data to understand the impact of disasters and improve disaster management. A study was conducted as a multidisciplinary, multi-stakeholder consortium. CDRs covering flood-affected areas were combined with remote sensing data (satellite images), rainfall data, census and civil protection data. The results showed that analyzing mobile activity during floods can potentially be used to locate damaged areas, assess needs and allocate resources. In addition, the study highlighted “the value of a public-private partnership on using mobile data to accurately indicate flooding impacts in Tabasco, thus improving early warning and crisis management.”
- › “Reinventing Society in the Wake of Big Data.” *Edge*. 30 August 2012. https://www.edge.org/conversation/alex_sandy_pentland-reinventing-society-in-the-wake-of-big-data
This page contains an audio and video link, and a transcription of a talk by Alex (Sandy) Pentland. He notes that big data reflects people’s behaviors, not their beliefs, and that there is great power in the analysis that can be done because of that. He cautions that, “The data is so big that any question you ask about it will usually have a statistically significant answer,” so new methods of analyzing and using the data need to be found. He sees as revolutionary the fact that big data allows us to see the dynamics of social interactions over time, and we are no longer limited to looking at averages like market indices.
- › Pawelke, Andreas and Tatevossian, Anoush Rima. “BLOG: DATA PHILANTHROPY: WHERE ARE WE NOW?” *UN Global Pulse*. May 8, 2013 <http://unglobalpulse.org/data-philanthropy-where-are-we-now>
This is an overview of data philanthropy (in 2013), including: the opportunities, ways of sharing data, and challenges.
- › Keen, Alex and Andrew. Video “Will the digital revolution improve our lives.” Debate at the Vodafone Institute Digitizing Europe Initiative, Berlin 2015. <https://www.youtube.com/watch?v=DWbHMMW9JVM0>
A debate over what benefits can come from the digital revolution and big data, and the potential harms.
- › Reid, Kyla. “Big Demand for Big Data: New Telenor study on Dengue Fever in Pakistan.” February 23, 2016. <http://www.gsma.com/mobilefordevelopment/Program/digital-identity/big-demand-for-big-data-new-telenor-study-on-dengue-fever-in-pakistan>

Challenges highlighted in this interview include the niche set of skills needed for data analysis and use, the need for a clear problem statement, and the importance of trust. The MNO also needs a clear problem statement. The study took two years to start, so time is factor to consider.

- › Robin, Nicholas, Thilo Klein, and Johannes Jütting. “Public-Private Partnerships for Statistics: Lessons Learned, Future Steps: A focus on the use of non-official data sources for national statistics and public policy.” OECD Development Co-operation Working Papers, February 29, 2016. http://www.oecd-ilibrary.org/development/public-private-partnerships-for-statistics-lessons-learned-future-steps_5jm3nqp1g8wf-en;jsessionid=1il6xlfhnp1c.x-oecd-live-02
This paper looks at issues related to big data from the perspectives of the commercial operations that produce the data, and the national statistical offices that use the data. It examines the incentives, business models and protocols that are needed to allow for use of non-official data sources by the official statistics community.
- › Roca, Thomas and Emmanuel Letouzé. “Open algorithms: A new paradigm for using private data for social good.” devex.com. 18 July 2016. <https://www.devex.com/news/open-algorithms-a-new-paradigm-for-using-private-data-for-social-good-88434>
This column discusses the ‘datafication’ of modern life, potential uses of this data and issues that can arise, and the aims of the OPAL initiative.
- › Romanoff, Mila, Miguel Calderon Lelo de Larrea, Michel Reveyrand-de Menthon, Alexandrine de Corbion, Fernando Sosa, Boris Wojtan. “How can Privacy help us harness ‘Big Data for Social Good?’” Panel at the Internet Governance Forum, Mexico 2016. <https://www.youtube.com/watch?v=16dcqo3jd9I>
This is a video of a conference session that aimed to share experiences in analysis of big data for social good, and to discuss privacy concerns. There is a write-up of the panel discussion at https://www.intgovforum.org/multilingual/filedepot_download/4098/225.
- › Romanoff, Mila. “Blog: Leveraging Data for Humanitarian Response Discussed at 37th International Conference of Data Protection & Privacy Commissioners.” *United National Global Pulse*. Nov 5, 2015. <http://unglobalpulse.org/blog/big-data-and-humanitarian-response-discussed-37th-international-conference-data-protection>
This blog reports on the discussion of the Data Protection & Privacy Commissioners, which included topics such as humanitarian agencies’ data protection measures, the development of guidance around data privacy, and the Commission’s adoption of a Resolution on Privacy and International Humanitarian Action.
- › Samarajiva, Rohan. “Guidelines for third party use of big data generated by mobile network operators.” Presentation at the Big data for development: Responsible use of mobile meta-data to support public purposes LIRNEasia event, Negombo, Sri Lanka, August 2014. <http://lirneasia.net/wp-content/uploads/2014/08/guidelines-ppt.pdf>.
The draft guidelines are also available at <http://lirneasia.net/wp-content/uploads/2014/08/Draft-guidelines-2.2.pdf>
- › Tatem, Andrew J, Youliang Qiu, David L Smith, Oliver Sabot, Abdullah S Ali and Bruno Moonen. “The use of mobile phone data for the estimation of the travel patterns and imported *Plasmodium falciparum* rates among Zanzibar residents.” *Malaria Journal*, 8:287 (2009). <https://malariajournal.biomedcentral.com/articles/10.1186/1475-2875-8-287>
This study showed that anonymized mobile phone records could provide a valuable data source for representing human movements without compromising the privacy of phone users.
- › Tatevossian, Anoush. Blog: “Interview: Telecom Italia’s “Big Data Challenge”. July 21, 2014 <http://unglobalpulse.org/big-data-challenge-telecom-italia>.

This piece is an interview with two Telecom Italia staff about their big data challenge, for which they made data available. They discuss the process of running a big data challenge and the company's motivations for doing so. They highlighted that this data represents one of the most valuable assets that operators hold.

- › Taylor, Linnet and Ralph Schroeder. "Is bigger better? The emergence of big data as a tool for international development policy." *GeoJournal*, (2015) 80: 503. <http://link.springer.com/article/10.1007%2Fs10708-014-9603-5>
This article uses three instances where big data has been used, and discusses the pros and cons, emerging practices, the potential for influencing development policy and ideas, and the politics of big data.
- › "The Mobile Economy 2016." *GSMA.com*. Accessed February 6, 2017. <http://www.gsma.com/mobileeconomy/>
This report gives a range of mobile statistics (e.g., mobile penetration), and talks about the contribution of mobile to the economy and development. It looks at rethinking regulation.
- › Stonier, JoAnn. "Guest Post: Data for Good, Challenges of Combining all that Data." *UN Global Pulse*, June 2015. <http://www.unglobalpulse.org/blog/guest-post-data-good-challenges-combining-data>
This blog discusses commercial enterprises donating their data for research.
- › "The Science and Ethics of Data for Good's New Frontier." *MasterCard Center for Inclusive Growth*, June 2015. <http://mastercardcenter.org/action/science-ethics-data-goods-new-frontier/>
This piece talks about the power of big data, and the privacy issues that arise.
- › Tudor, Grant. "The Age of Big Data." *next billion*. October 20, 2011. <http://nextbillion.net/the-age-of-big-data/>
This short piece talks of the potential power of big data. It touches on Nathan Eagle's suggestion of using mobiles to do global-level data gathering instead of traditional surveys, and the fact that we leave digital traces of our behavior
- › United Nations General Assembly. A/RES/45/95 (1990). Guidelines for the regulation of computerized personal data files. 14 December. Available at <http://www.un.org/documents/ga/res/45/a45r095.htm>
- › United Nations Global Pulse. "Blog: Responsible Data Forum on Private Sector Data Sharing – Event Summary." August 25, 2014. <http://unglobalpulse.org/RDF-private-sector-data-summary>
This is a summary of an event involving 30 experts from the private sector, academia, civil society, law and philanthropy. The group aimed to explore ethical, privacy and safety factors around private sector data sharing. They also looked at practical issues such as data de-identification.
- › United Nations Global Pulse. "Mobile Network Data for Development." October 2013. http://www.unglobalpulse.org/sites/default/files/Mobile%20Data%20for%20Development%20Primer_Oct2013.pdf
This piece shows the data elements contained in CDRs, gives examples of use of CDRs (disaster response, and health, socio-economic and transportation analysis), and touches on privacy challenges.
- › United Nations Global Pulse. "Mapping the Risk-Utility Landscape of Mobile Data for Sustainable Development & Humanitarian Action." *Global Pulse Project Series no. 18*, 2015. <http://www.unglobalpulse.org/projects/mobile-data-privacy>
This project looked at how analysis of mobile data can be used for policy planning and crisis response while minimizing privacy risks. It examined the impacts of aggregating mobile data to

protect privacy upon the utility of the data for transportation planning and pandemic control and prevention. Re-identification risks were explored. It sought to lay the groundwork for development of data standards and policy frameworks to balance the risk of harm due to the misuse of mobile data and the risk of harm due to a failure to use it.

- › United Nations Global Pulse. “Improving Data Privacy & Data Security in ICT4D: Meeting Report.” May 8, 2015. UN Headquarters, New York. <http://www.unglobalpulse.org/sites/default/files/Data%20Privacy%20and%20Security%20in%20ICT4D%20-%20conference%20report%20layout%20-%20FINAL.pdf>
The workshop dived into principle 8 (“Address Privacy & Security”) of the Principles for Digital Development. One session covered data privacy policies, and the second data security practices. It addresses topics related to developing a good privacy policy, and a risks, harms and benefits framework.
- › United Nations Global Pulse. Report on “Big Data for Development and Humanitarian Action: Towards Responsible Governance. Global Pulse Privacy Advisory Group Meetings 2015 – 2016.” <http://www.unglobalpulse.org/news/big-data-development-and-humanitarian-action-towards-responsible-governance-report>
Report on selected issues and recommendations for the use of big data in development and humanitarian contexts that emerged from the Global Pulse Privacy Advisory Group discussions.
- › United Nations Global Pulse. “Big Data for Development: Opportunities & Challenges.” May 2012. <http://www.unglobalpulse.org/sites/default/files/BigDataforDevelopment-UNGlobalPulseMay2012.pdf>
This paper outlines the main concerns and challenges related to big data for development, and suggests some ways of addressing these.
- › UN Global Pulse. Risk, Harms, Benefits Assessment Tool, <http://www.unglobalpulse.org/privacy/tools>
UN Global Pulse is developing a two phase “Risks, Harms and Benefits Assessment Tool, a data privacy, ethics and data protection compliance mechanism for understanding and managing risks, harms and benefits associated with big data use in development and humanitarian contexts.
- › United Nations Development Group. “Guidance Note on Big Data for SDGs: Data Privacy, Data Protection and Data Ethics.” March 2017. <https://undg.org/document/undg-guidance-note-on-big-data-for-achievement-of-the-2030-agenda-data-privacy-ethics-and-protection/>
This document sets out general guidance on data privacy, data protection and data ethics for the United Nations Development Group concerning the use of big data, collected in real time by private sector entities as part of their business offerings, and shared with UNDG members for the purposes of strengthening operational implementation of their programs to support the achievement of the 2030 Agenda.
- › Wetter, Erik. “Guest Blog: Mobile networks – Using data to help aid agency response.” January 20, 2015. <http://www.millicom.com/media/millicom-blogs/blog-mobile-networks-using-data-to-help-aid-agency-response/>
Erik Wetter describes a range of Flowminder work using big data for humanitarian purposes.
- › Yoon Sung-won. “KT Chairman vows to fight epidemics.” *The Korea Times*. Accessed February 6, 2017. http://www.koreatimes.co.kr/www/news/tech/2016/06/133_207854.html
This ITU blog describes a project done in partnership with the government of Japan to use big data to help aid agencies track the outbreak of disease while safeguarding individual privacy. As a neutral international body, the ITU obtained data from MNOs, and provided free software to anonymize the data, which was then stored in the cloud on an ITU server, or on a country server. NGOs could then request access to this information.



This document was produced with the support of the Vodafone Americas Foundation. The Vodafone Americas Foundation is part of Vodafone's global network of 27 foundations. It is affiliated with Vodafone Group. The Vodafone Americas Foundation supports programs in the United States and abroad to Improve People's Lives, Support the Development Sector, Spark Innovation, and Empower Women and Girls. For more information, please visit: www.vodafone-us.com.



This document is an output of a project funded by UK aid from the Department for International Development (DFID), for the benefit of developing countries. The views expressed are not necessarily those of DFID.



June 2017