Mobile Big Data Solutions for a Better Future

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with almost 400 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 the industry-leading MWC events held annually in **Barcelona**, **Los Angeles** and **Shanghai**, as well as the **Mobile 360 Series** of regional conferences.

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

Follow the GSMA on Twitter: **@GSMA**

Note to Reader

This Report has been prepared by PricewaterhouseCoopers Australia (PwC) in our capacity as consultants to GSMA. The content of this report has been prepared relying upon publicly available material, discussions with industry experts and stakeholders, and material provided by GSMA. PwC is not liable for the accuracy of this report when used or relied upon by a third party. PwC accepts no responsibility for errors in the information sourced or provided nor the effect of any such errors on our analysis, suggestions or report. The report is based on primary market research and analysis conducted by PwC between March and July 2019.

Contents

Executive Summary

Mobile big data offers an opportunity to create widespread social impact in line with the United Nations Sustainable Development Goals. Governments and development agencies are seeking new ways to improve how they design, implement and monitor projects through harnessing more accurate, timely and accessible information. The proliferation of mobile networks combined with new capabilities in leveraging “mobile big data” (MBD) presents a generational opportunity to address this problem since MBD solutions already generate rich and timely insights that can now be harnessed to drive social impact.[1]

This report highlights the world of opportunity that MBD offers for social impact, giving visibility to MBD’s potential through case illustrations, highlighting the principles that apply to using MBD for social good, offering a framework for showcasing MBD’s benefits to users on the ground and outlining a call to action. Potential impact can only be realised through investment and innovation to harness MBD’s benefits, developing practices in government and development agencies to adopt MBD into projects, and protocols to utilise MBD effectively, ethically and responsibly. This report illustrates the potential returns and underlines the critical role MBD must play in attaining the UN Sustainable Development Goals (SDG) by 2030. MBD for Social Good builds on the significant impact of MBD powered applications and services used by millions of mobile subscribers already on a daily basis.

1. MBD solutions refer to network traffic, usage and communications data (from people, sensors and connected devices), combined with wider data sets and harnessed through big data analytics, artificial intelligence and machine learning.

Over 150 million people across advanced and emerging countries could be positively impacted by the beneficial impacts of MBD solutions on projects within the next five years.[2]

Globally, the potential for MBD to create social impact across the topics covered by the SDGs is immense, and supports the need for investment in MBD related capabilities and implementations. Case analysis documented in this report shows how MBD has the potential, conservatively, to touch at least 3 per cent of the world’s population through improving public project effectiveness. The cases that follow illustrate five instances of the many ways in which MBD could make a difference by as early as 2025. Details are provided in the main body of the report and appendices.

60 million people across the 41 most affected countries could have better access to healthcare due to more informed infrastructure planning via MBD solutions that target health facility deployment planning.

Worldwide, 1.5 billion people lack access to essential health care today. MBD solutions supporting projects in the most affected countries could reduce this lack of access by 4 per cent. Mobile location data provides unique insights on population density and seasonal migration patterns, and this can be used to increase the effectiveness of where planners locate health centres or optimise health centre deployment and release funds for other priorities. In 41 countries mainly in South Asia and Sub-Saharan Africa, MBD solutions could result in 60 million more people accessing healthcare by 2025.[3] As an alternative, greater precision in locating health centres could otherwise result in releasing up to US$ 100 million in funds to focus on other priorities.

120,000 additional lives across the world’s most populated cities could be saved as a result of better-informed measures to limit air pollution, resulting in lower congestion and better transport planning.

According to the World Health Organisation, over 90 per cent of the world’s population live in areas that fall below minimum air quality standards, one of the principal causes of premature death.[4] City authorities could draw upon MBD solutions using insights from aggregated and anonymised calling patterns, SMS and phone tower data to reduce motor traffic congestion in highly polluted areas, as well as to enrich the quality of long-term transport planning. Across 15 of the world’s most populated cities which have air pollution levels significantly exceeding WHO guidelines, MBD solutions could result in 120,000 fewer deaths from air pollution over the next five years.[5]

2. MBD interventions across the SDG themes examined show the potential of a greater than 3 per cent impact on project effectiveness to impact affected populations. Assuming that the projects implemented under the framework themes touch 5 billion population (i.e. approximately 70 per cent of world population), this implies that MBD-enabled interventions may impact the lives of some 150m people.
3. Afghanistan, Angola, Bangladesh, Benin, Bhutan, Bosnia and Herzegovina, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Ethiopia, Gabon, Ghana, Guatemala, Guinea, Guinea-Bissau, Haiti, India, Indonesia, Kenya, Lesotho, Liberia, Malawi, Mali, Mauritania, Namibia, Nepal, Niger, Nigeria, Pakistan, Papua New Guinea, Philippines, Samoa, Senegal, Solomon Islands, Togo, Uganda, Vanuatu, Zambia, and Zimbabwe.
4. 9 out of 10 people worldwide breathe polluted air, but more countries are taking action (WHO, 2018). Access: https://www.who.int/news-room/detail/02-05-2018-9-out-of-10-people-worldwide-breathe-polluted-air-but-more-countries-are-taking-action
5. Dhaka, Shanghai, Mumbai, Baghdad, Yangon, Lagos, Karachi, São Paolo, Lima, Riyadh, Omdurman, Madrid, Bangkok, Istanbul, and Ho Chi Minh City.

By 2025 over 25,000 additional lives could be saved from natural disasters in major at-risk countries, as a result of MBD-enabled solutions to aid quicker evacuation from dangerous areas, also saving multiples more from injury and US$1.9 billion of movable assets from damage.

Natural disasters result in devastating impact on human lives, and over the past 20 years, there have been 1.3 million deaths from natural disasters.[6] MBD solutions using location data from mobile subscribers and connected devices (such as vehicles), combined with traffic and weather reporting data can be used to better identify populations at risk, deploy rescue workers more precisely to areas of need, and clear escape routes faster. Across 55 countries including China, the US and Japan, police, ambulance, fire and rescue and evacuation teams could reduce mortalities from natural disasters by an additional 7 per cent, as well as safeguard citizens from injury and save movable assets such as vehicles and personal possessions from damage.[7]

Communicable diseases could be significantly reduced from spreading by targeting locations at risk of exposure through MBD solutions to understand population movements. This could result in some 650,000 fewer cases of tuberculosis alone in the next five years.

Communicable diseases such as tuberculosis, dengue fever, cholera, hepatitis B and malaria claim millions of lives annually. There have been over 450 million cases of these diseases estimated annually in recent years.[8, 9, 10, 11, 12] To reduce deaths from communicable diseases, location data from cohorts of mobile subscribers could be used to more precisely identify geographic areas at high risk of infectious spread. In the most susceptible countries across Asia and Africa, targeted prevention, diagnosis and treatment using MBD could reduce an additional 650,000 cases of tuberculosis alone over five years, equivalent to a reduction of over 1 per cent.[13, 14]

70 million more adults could take up financial services across the 58 countries in Africa, Asia and Latin America which have over 40 per cent of adults unbanked, using MBD solutions to target groups to raise awareness, trust and confidence in digital financial services.

There are almost 60 countries with 40 per cent or more unbanked adult population today, mainly in Africa, Asia and Latin America.[15] By analysing mobile network data to better understand the needs of the unbanked, widespread information campaigns to enhance public awareness, trust and confidence in the benefits of digital financial services could result in 70 million more adults using such services in the next five years, resulting in a further 8 per cent reduction in unbanked population.[16]

6. Natural Disasters (Our World in Data, 2018). Access: https://ourworldindata.org/natural-disasters
7. Afghanistan, Algeria, Angola, Bangladesh, Benin, Brazil, Burkina Faso, Cambodia, Cameroon, Chile, China, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Ethiopia, Ghana, Guatemala, Haiti, Honduras, India, Indonesia, Iran, Italy, Japan, Kenya, Madagascar, Malaysia, Mali, Mexico, Morocco, Mozambique, Myanmar, Netherlands, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Peru, Philippines, Senegal, South Africa, Sri Lanka, Sudan, Thailand, Turkey, Uganda, United Kingdom, United States of America, Uzbekistan, Venezuela, Vietnam and Zimbabwe..
8. Tuberculosis (WHO, 2018). Access: https://www.who.int/news-room/fact-sheets/detail/tuberculosis.
9. Dengue and severe dengue (WHO, 2019). Access: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue
10. Cholera (WHO, 2019). Access: https://www.who.int/news-room/fact-sheets/detail/cholera
11. Hepatitis B (WHO, 2019). Access: https://www.who.int/news-room/fact-sheets/detail/hepatitis-b
12. Malaria (WHO, 2019). Access: https://www.who.int/news-room/fact-sheets/detail/malaria
13. Afghanistan, Angola, Bangladesh, Bhutan, Bolivia, Botswana, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Ethiopia, Gabon, Ghana, Guinea, Guinea-Bissau, Haiti, India, Indonesia, Kenya, Lesotho, Liberia, Madagascar, Malawi, Malaysia, Mauritania, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Niger, Nigeria, Pakistan, Papua New Guinea, Peru, Philippines, Senegal, Sierra Leone, South Africa, Tanzania, Thailand, Uganda, Vietnam, Zambia, and Zimbabwe.
14. There were 8.1 million cases of tuberculosis across our target countries in the last reported year. Globally TB incidence is falling at about 2 per cent per year. Therefore there are 35.3 million cases across 5 years. This represents an improvement of 1.84 per cent as a result of MBD intervention (650,000/35,300,000 = 1.84 per cent).
15. Argentina, Armenia, Azerbaijan, Bangladesh, Benin, Bosnia and Herzegovina, Botswana, Burkina Faso, Cambodia, Cameroon, Central African Republic, Chad, Colombia, Dominican Republic, Ecuador, El Salvador, Ethiopia, Ghana, Guatemala, Guinea, Haiti, Honduras, Indonesia, Jordan, Kazakhstan, Lebanon, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mexico, Moldova, Morocco, Mozambique, Myanmar, Nepal, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Romania, Rwanda, Senegal, Sierra Leone, Tajikistan, Tanzania, Togo, Tunisia, Uganda, Uzbekistan, Vietnam, Zambia, and Zimbabwe.
16. The headline is drawn from applying each reference country to 58 countries which represents a cut-off rate of all countries with an unbanked population of 40 per cent or more of adults (this represents a present figure of some 889m unbanked adults across these countries).

MBD impacts can be both direct and indirect, underlining further the need for collaboration to realise the benefits. The illustrative examples above highlight that MBD can have a direct impact on outcomes that create social impact, for example where using MBD to improve the precision of health centre location. The examples also indicate that MBD can have indirect impact, for example, to inform policy makers on designing measures to control or limit air pollution in cities. Realising indirect and direct MBD impacts to create social impact will require developing new ways of working and different collaboration models between mobile network operators (MNOs) and government agencies, as well as workflow redesign and capability development.

The GSMA has been working with PwC to develop a first-of-a-kind framework to assess how MBD can make a difference to society. The framework consists of themes which link to the UN SDGs and offers a profound opportunity to tap MBD to uplift project effectiveness by:

- **enabling timelier, more targeted and cost-effective project intervention,** with impact on a wide range of projects across the themes covered by the UN SDGs;
- **justifying investment** in MBD-related capabilities and implementations by estimating impact on a country-by-country basis and aggregating such impacts to determine potential global impact;
- **promoting inclusion** of citizens who may be remote, whose movements may not be well understood, or who might not be covered sufficiently - through traditional project planning;
- **impacting effectiveness** at all points of the project cycle, from identification to planning, implementation and monitoring;
- **stimulating innovation** in problem solving, as the richness and versatility of MBD creates new insights and triggers novel approaches to framing and addressing problems.
- **uplifting all nations** since MBD will impact topics such as natural disaster management and urban pollution control, matters which impact advanced as well as emerging countries; and
- using mobile technology to address a long-term public project problem **ethically in accordance with accepted data use standards and protocols.**

The framework, illustrated in Figure 1, is arranged into five themes which represent policy priority areas, each supported by a calculation engine that assesses potential MBD impacts. The framework is supported by data available from an emerging body of research into MBD interventions, based on responsible and transparent use of mobile network data compliant with usage principles and regulations.

Figure 1 Source: PwC

Mobile Big Data Impact Assessment Framework

PRIORITY THEMES	Cities, Infrastructure and Economic Growth	Climate Change and Environment	Managing Disasters	Health and Education	Citizen Inclusion
SUB-THEMES	Health Facility Deployment	Air Pollution	Emergency Response	Infectious Disease	Financial Services
	Electricity Access	Climate Migration	Disaster Displacement	School Connectivity	Crime Prevention
	Public Transport	Safe Water	Disaster Reconstruction	Ambulance Services	Poverty Reduction
	Roads and Highways				Food Security

Realising the potential of MBD requires implementation by a global cohort of practitioners

MBD for social impact goes to the heart of today's pressing need for governments and international development agencies to enhance the effectiveness of public initiatives which use scarce and tightly budgeted resources. Leveraging MBD also presents an immediate opportunity to stakeholders under pressure to attain the UN SDG targets for 2030.

Realising this potential places a call to action upon stakeholders to adopt change at a local and global level, through the following steps:

Secure commitment and encourage collaboration

between public organisations, civil society, non-governmental organizations (NGO), mobile network operators and stakeholders to work together and understand how MBD solutions and capabilities can help solve problems, save lives, enhance project outcomes and reduce cost. This will involve securing commitments to MBD adoption, as well as identifying challenges and barriers to uptake for the use of MBD to create social impact, both directly and indirectly as outlined in the illustrative cases above.

Invest in and refine end to end processes in implementing organisations

spanning project identification, design and execution, so that MBD solutions result in integrating insights and creating measurable impacts. This will involve identifying change initiatives in government agencies and development organisations to adopt and use MBD solutions, investing in skills and organisation development, as well as measuring how MBD will contribute to attaining the UN SDG goals for 2030.

Design MBD solutions for scale

to enable countries and organisations to move quickly from being stimulated by inspiring examples of social impact, to achieving widespread scale through repeatable implementation in different and localised environments and circumstances. This will involve implementing agencies and mobile network operators working with others to build sustainable solutions and scale impact.

Adopt privacy and ethics practices and frameworks

to continue to promote responsible use of data for generating social impact in public projects.

Build sustainable models

for solution development and scaling, so governments, development agencies, execution partners, mobile network operators and other ICT companies can work together to implement MBD solutions which are sustainable over a long period of time and are supported by business models that encourage continued investment and innovation by all parties involved.

Since much of the core mobile infrastructure and connectivity requirements are in place, governments and mobile network operators can work together and with wider stakeholders to focus on how MBD should be used for maximum impact, and the solution creation required to enable this. This also provides MNOs an opportunity to develop and apply their capabilities in mobile data analytics to better support demand for MBD interventions for social impact. Based on a collaborative approach, the returns on using MBD can be expected to be high, combining widespread human and social impact with better value-for-money, project transparency and public policy effectiveness.

Maximising social impact

MBD has the potential to make a difference to society

Governments and development agencies are constantly seeking new ways to improve how they design, implement and monitor projects through harnessing more accurate, timely and accessible data to improve project effectiveness. Moving from project design to execution can take several years, and by the time execution is underway the problem statement originally identified may have evolved significantly. Similarly, in government interventions such as emergency response to a natural disaster or a health epidemic, effective outcomes are also dependent on the timeliness, accuracy and legitimacy of information.

The proliferation of mobile networks combined with the advent of big data creates an opportunity for governments and development agencies to address this problem since MBD solutions can generate richer and timelier insights that can drive project and social impact. MBD solutions refer to network traffic, usage and communications data (from people, sensors and connected devices), combined with wider data sets, (such as public data from government agencies, private data third parties, and traditional data from surveys), harnessed through big data analytics, artificial intelligence and machine learning.

Globally, the potential for MBD to create social impact across the topics covered by the SDGs is immense. Initial case analysis documented in this report indicates MBD has the potential to touch at least 3 per cent of the world's population through improving public project effectiveness. If this is achieved, then over 150 million people across advanced and emerging countries could be positively impacted by the benefits of MBD solutions by enhancing project effectiveness.[17]

Large volumes of network data are created in mobile networks as a result of the daily functions of providing network connectivity and delivering communication services. This includes information on user location, social networks, profile data, usage and spend. MNOs processing this data are accountable for upholding relevant data protection and telecommunications laws, and should also consider alignment with privacy principles, such as the GSMA Mobile Privacy Principles.[18] In some cases, depending on relevant laws, MBD may be pseudonymised by the MNO to glean insights in a way that minimises privacy risks.[19] Further, anonymising and aggregating MBD also preserves privacy while also providing valuable insight on a wide variety of issues such as population movement and density and demographic information such as age and gender, adding valuable layers of insight to guide project decision-making.

17. MBD interventions across the themes examined show the potential of a greater than 3 per cent impact on project effectiveness to impact affected populations.
18. The GSMA works with governments, regulators and the wider mobile industry to promote transparency and choice and to encourage responsible privacy governance practices, for example through the GSMA Privacy Principles. For more information, please refer to our Privacy resources: https://www.gsma.com/publicpolicy/consumer-affairs/privacy
19. Pseudonymised data is data that has been processed in such a manner that the personal data can no longer be attributed to a specific subject without the use of additional information. For data to be treated as pseudonymous, that additional information must be kept separately and subject to technical and organisational measures to ensure that the personal data is not attributable to a person.

7 Mobile Big Data Principles for Social Good

Applying MBD for social good follows seven core principles, illustrated in Figure 2 and explained below:

Figure 2

Source: PwC

Coverage

Mobile network coverage now extends to nearly three quarters of the world, due to reach 5.8 billion human connections by 2025, representing 71 per cent of global population.[20] This means public projects which draw upon mobile operational data have a high chance of covering most of the global population addressed via public projects.

Digital

Mobile networks collect raw operational data across multiple fields on a minute-by-minute basis, for up to billions of connections spanning handsets and connected devices (such as IoT devices) which can then be quality-checked, treated and processed for further use with other data sets. Data collection by network operators can, therefore, be reliable, thorough and repeatable, providing an opportunity to assimilate and process such data into meaningful analytics to influence project impact.

Consistency

Whilst mobile networks are uniquely configured and designed, most networks have the capability to report similar types of operational data and network information. This means that MBD fields, with the necessary treatment to harmonise data collected on different networks, can be more consistent across nation states compared to traditionally collected data, such that MBD has the potential to create insights for discerning common patterns which can help scale impacts worldwide.

Uniqueness

Due to coverage and timeliness, analysis of MBD sets can be processed and analysed to generate unique and powerful insights which can then be tailored to address specific needs that inform project delivery and decision making in a way that almost no other form of data collection could match.

Authenticity

MBD is principally collected over networks, and many data fields (such as location, usage and movement) are not subject to the occasional inaccuracy of surveys and other manual data collection. MBD can be subject to error and requires quality assurance, but an important advantage of automated data collection is that it can be done consistently.

Timeliness

Data collected from mobile networks can be timelier than that produced from surveys and other more traditional data sourcing methods. In future, as network operators' capabilities to run analytics on real-time data grows, such data will add further potential to increase project impact in time-sensitive topics such as disaster management and emergency services.

Responsibility

The mobile network industry is a licensed and regulated activity in most countries, subject to current (and emerging) regulation and standards which condition responsible and ethical use of data, providing important confidence to policy makers who wish to benefit from MBD without putting individual citizens' privacy at risk.

20. The Mobile Economy (GSMA, 2019). Access: https://www.gsmaintelligence.com/research/?file=b9a6e6202ee1d5f787cfebb95d3639c5&download

The GSMA has been working with PwC to develop a first-of-a-kind framework to assess how MBD can make a difference to society. The framework consists of themes which link to the UN SDGs and offers a profound opportunity to tap MBD to uplift project effectiveness by:

Enabling timelier, more targeted and cost-effective project intervention, with impact on a wide range of projects across the themes covered by the UN SDGs.

Promoting inclusion of citizens who may be remote, whose movements may not be well understood, or who might not be covered sufficiently - through traditional project planning.

Justifying investment in MBD-related capabilities and implementations by estimating impact on a country-by-country basis and aggregating such impacts to determine potential global impact.

Impacting effectiveness at all points of the project cycle, from identification to planning, implementation and monitoring.

Encouraging innovation in problem solving, as the richness and versatility of MBD can spark new ideas for analysis, and trigger new approaches to framing problems.

Uplifting all nations since MBD will impact topics such as natural disaster management and urban pollution control, matters which impact advanced as well as emerging countries.

Using mobile technology to address a long-term public project problem **ethically in accordance with accepted data use regulations and principles.**

The Framework groups the SDGs into five priority themes determined by considering where MBD interventions are impacting SDGs, and relevance to government officials, city administrators and development and humanitarian agencies, who are the intended users of the framework. Under each theme there are sub-themes to outline specific use cases of MBD interventions. The themes are as follows:

Cities, Infrastructure, Economic Growth

Climate Change and Environment

Managing Disasters

Health and Education

Citizen Inclusion

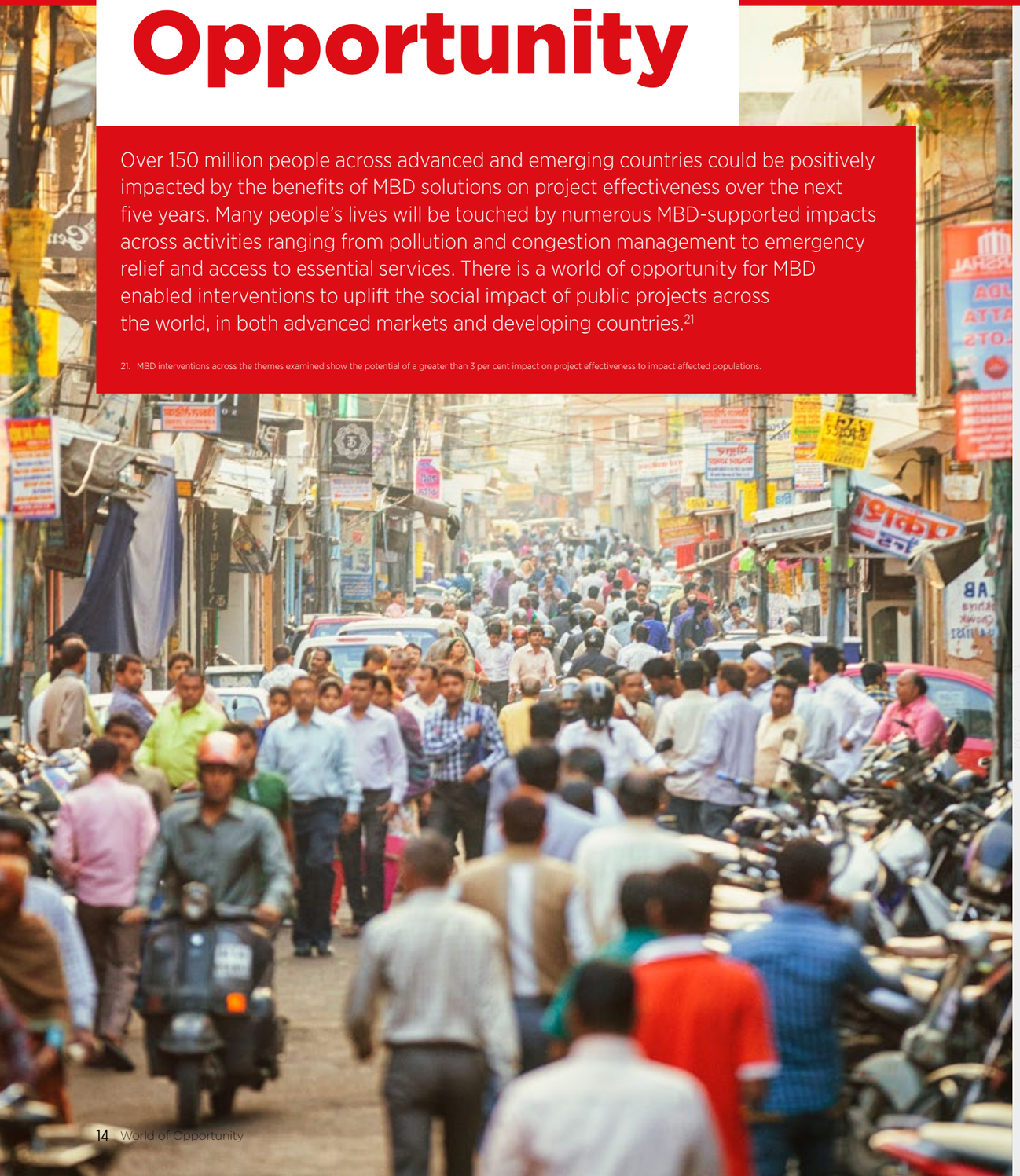
Each theme is supported by a calculation engine that assesses potential MBD impact applied to target countries. The framework, depicted in Figure 3, is built upon available research into MBD interventions around the world, drawing upon responsible and transparent use of mobile network data, compliant with data usage principles and regulations. Framework development has been supported by a panel of active mobile network operators developing real-world solutions in various markets.

Figure 3 Source: PwC

Mobile Big Data Impact Assessment Framework

PRIORITY THEMES	Cities, Infrastructure and Economic Growth	Climate Change and Environment	Managing Disasters	Health and Education	Citizen Inclusion
SUB-THEMES	Health Facility Deployment	Air Pollution	Emergency Response	Infectious Disease	Financial Services
	Electricity Access	Climate Migration	Disaster Displacement	School Connectivity	Crime Prevention
	Public Transport	Safe Water	Disaster Reconstruction	Ambulance Services	Poverty Reduction
	Roads and Highways				Food Security

World of Opportunity



Over 150 million people across advanced and emerging countries could be positively impacted by the benefits of MBD solutions on project effectiveness over the next five years. Many people's lives will be touched by numerous MBD-supported impacts across activities ranging from pollution and congestion management to emergency relief and access to essential services. There is a world of opportunity for MBD enabled interventions to uplift the social impact of public projects across the world, in both advanced markets and developing countries.[21]

21. MBD interventions across the themes examined show the potential of a greater than 3 per cent impact on project effectiveness to impact affected populations.

Mobile Big Data Solutions for a Better Future

Applying the framework, this section illustrates this global potential by articulating selected case study "spotlights" under design or being implemented by GSMA partners, as shown in Figure 4. The spotlights present illustrative outcomes consisting of a headline statement which underlines the potential, and practical illustrations of how MBD can make a specific difference. A detailed methodology describing how the potential impacts have been calculated is outlined in Appendix 2.

Figure 4

Spotlight case studies across the Impact Assessment Framework

FRAMEWORK THEME	Cities, Infrastructure, Economic Growth	Climate Change and Environment	Managing Disasters	Health and Education	Citizen Inclusion
SPOTLIGHT CASE WITH FIVE YEAR IMPACT	Extending coverage of essential health services	Reducing air pollution in major cities	Responding effectively to natural disasters	Preventing the outbreak of infectious diseases	Increasing access to financial services

Cities, Infrastructure and Economic Growth

3 GOOD HEALTH AND WELL-BEING

11 SUSTAINABLE CITIES AND COMMUNITIES

Spotlight

Extending coverage of essential health services

60 million people across the 41 most affected countries could have better access to healthcare due to more informed infrastructure planning via MBD solutions that target health facility deployment planning.

What's at stake

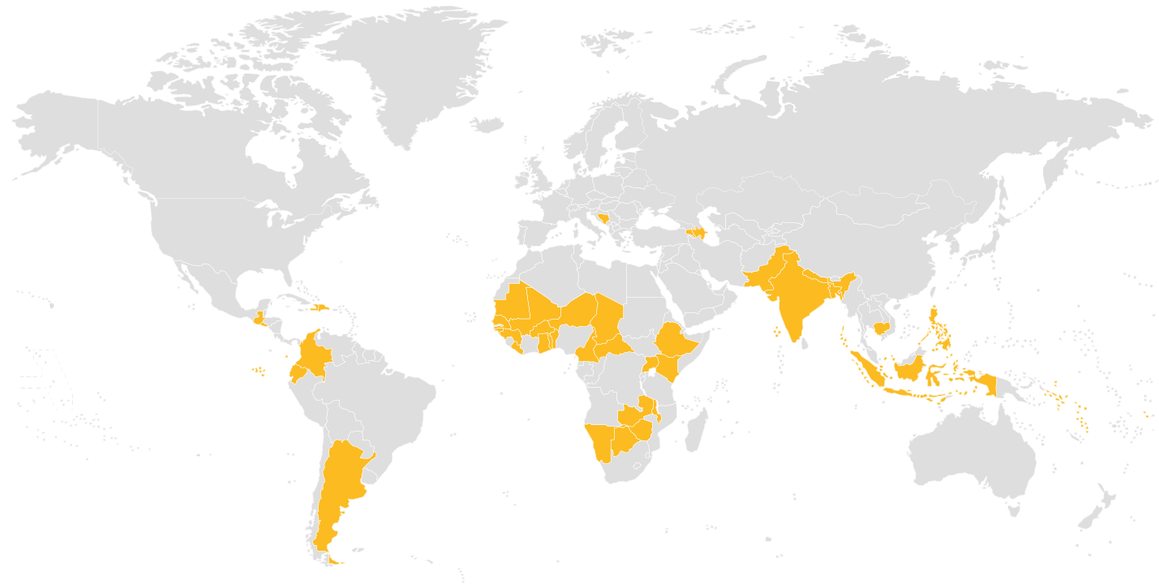
There are approximately 1.5 billion people today lacking access to essential health care coverage, with most living in the 41 most-impacted countries listed in Figure 5 below.[22] Increasing access places a heavy strain on public health planners to decide precisely where to position costly new health facilities, in a bid to maximise reach and impact by allocating limited investment resources.

22. Countries have been selected with coverage below 60 per cent as determined by the World Health Organisation.

Figure 5

Source: PwC analysis

Most impacted countries where MBD-supported initiatives could improve health care coverage



World of Opportunity

MBD-supported initiatives could improve healthcare access by 4 per cent. Across the 41 countries listed above, MBD-enabled insights could result in at least 60 million more people accessing basic healthcare. Alternatively, the insights available from MBD solutions could be used to reach the same number of people as today, but at reduced infrastructure expenditure of some US$100 million by optimising health facility planning and releasing funds to address other public health priorities.

Role of MBD

Mobile location data can be used to provide insights on population density and seasonal migration patterns to inform better placement and deployment of healthcare facilities, therefore increasing popular access to healthcare. When aggregated mobile location data is combined with population growth forecasts, health facility data (e.g. current locations and catchment areas) and disease burden data (e.g. number of patients diagnosed and undergoing treatment), the location of health facilities can be optimised for access to more of the population. MBD-enabled insights will be of direct relevance to health facility planners in need of more timely and reliable data on population movements and location.

Reference case

In Malawi, the Ministry of Health (MoH) plans to optimise investment in 900 new health facilities and roll them out by 2023. The project draws upon MBD insights to uniquely determine seasonality of people movement across Malawi to help plan more precisely where to build centers, maximising population access and improving project spending efficiency.

Climate Change and Environment

13 CLIMATE ACTION

11 SUSTAINABLE CITIES AND COMMUNITIES

Spotlight

Reducing air pollution in major cities

120,000 additional lives across the world's most populated cities could be saved as a result of better-informed measures to limit air pollution, resulting in lower congestion and better transport planning.

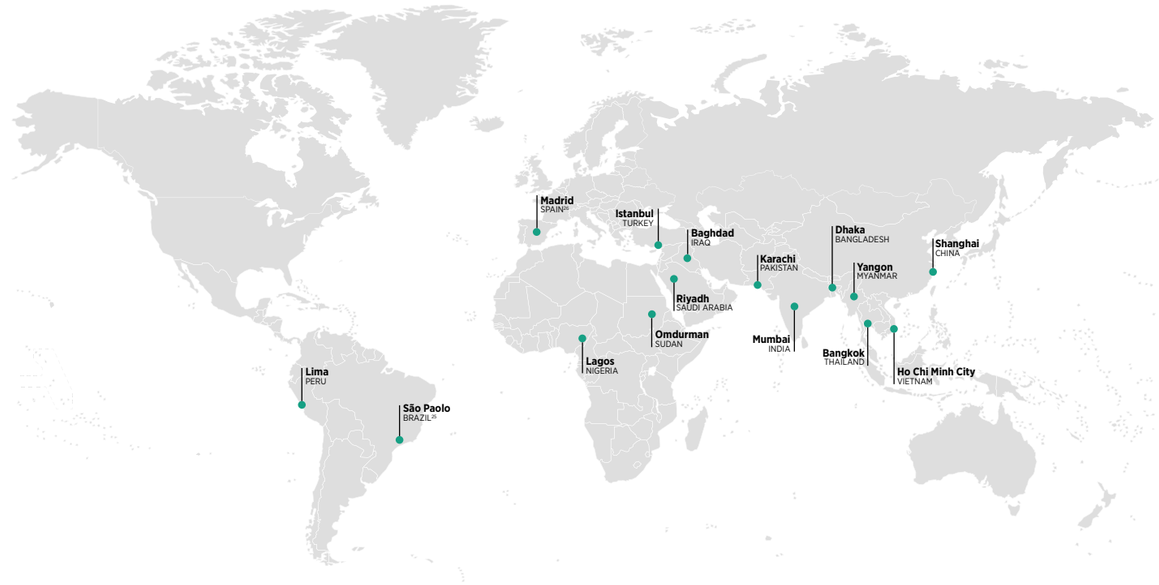
What's at stake

According to the World Health Organisation, over 90 per cent of the world's population live in areas that fall below minimum air quality standards and this is one of the principal causes of premature death.[23] There are at least 15 major cities, shown in Figure 6, around the world exposed to levels of air pollution far exceeding WHO guidelines around the world.

23. 9 out of 10 people worldwide breathe polluted air, but more countries are taking action (WHO, 2018). Access: https://www.who.int/news-room/detail/02-05-2018-9-out-of-10-people-worldwide-breathe-polluted-air-but-more-countries-are-taking-action

Figure 6 Source: PwC analysis

Most populous cities exposed to high levels of air pollution[24]



World of Opportunity

An estimated 120,000 lives could be saved as a result of better-informed traffic restriction measures to limit air pollution across the cities listed above. These response measures could reduce impacts of air pollution on cardiovascular and respiratory disease, and cancers across cities in Asia, Latin America and Europe.[27]

Role of MBD

Mobility insights from aggregated and anonymised calling patterns, SMS and phone tower data, are highly correlated (up to 94 per cent) with actual observed traffic and can be used to provide estimates of traffic in real-time using data from the mobile network.[28] This improves the ability of city authorities to inform short-term policy measures such as dynamic traffic management in city centers, as well as enrich the quality of long-term transport planning. Access to the measurement of traffic and congestion in real time supports government authorities to respond to excessive levels of air pollutants that can be associated with mobility.

Reference Case

In both São Paulo and Madrid, Telefónica is working to harness mobile network data to help combat the adverse health impact of air pollution. These cities are two of many large cities globally who between them experience some 4.2 million deaths as a result of exposure to ambient outdoor air pollution, and who have, therefore, used traffic restrictions to manage the issue.[29] This mortality rate is partly due to exposure to small particulate matter of 2.5 microns or less in diameter (PM2.5) and nitrogen dioxide (NO2) to which road traffic is a contributor.

24. Countries have been selected basis of having average annual PM2.5 levels greater than 25ug/m3, as well as populations near or exceeding 5 million inhabitants, as well as including two cities, Madrid (Spain) and São Paolo (Brazil) which are the subject of the current MBD4SG case being implemented by Telefonica.
25. See footnote 18.
26. See footnote 18.
27. Air Pollution (WHO, 2019). Access: https://www.who.int/airpollution/en/
28. Case Study: Telefonica Brazil. Access: https://bigdatatoolkit.gsma.com/resources/Big-Data-for-Social-Good_TEF_Brazil_Case-Study.pdf
29. Air Pollution (WHO, 2019). Access: https://www.who.int/airpollution/en/

Managing Disasters

13 CLIMATE ACTION

Spotlight

Responding effectively to natural disasters

By 2025 over 25,000 additional lives could be saved from natural disasters in major at-risk countries, as a result of MBD-enabled solutions to aid quicker evacuation from dangerous areas, also safeguarding thousands from injury and saving US$ 1.9bn of movable assets from damage.

What's at stake

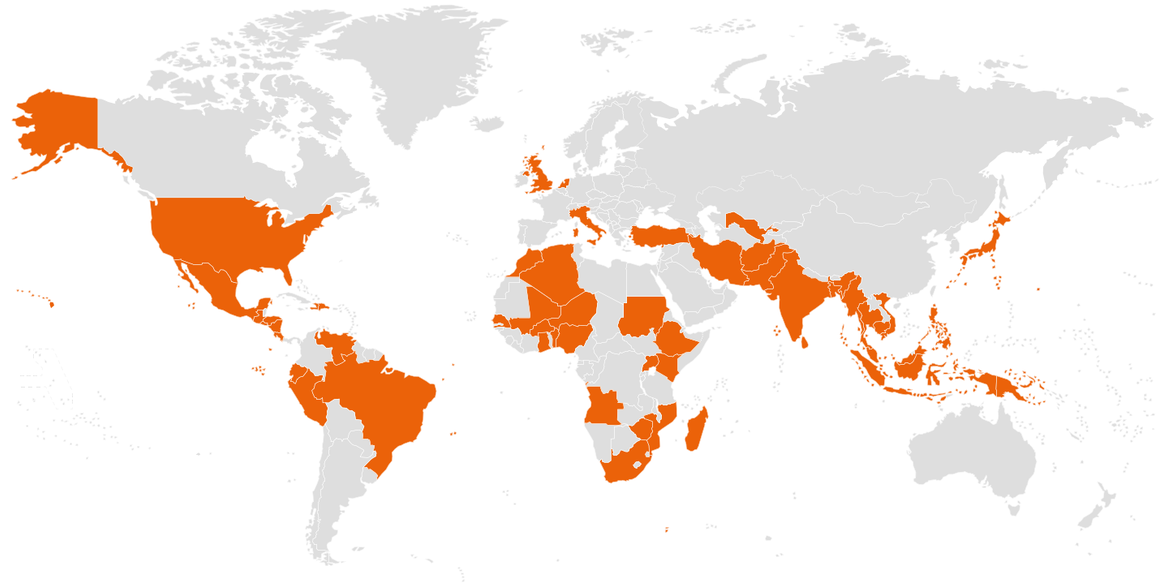
Over the past 20 years, some 1.3 million people have died as a result of natural disasters around the world. Countries with large at-risk populations from natural disasters are listed in Figure 7, with multiples more suffering from disaster-related injury and illness.[30]

30. Countries in this table have a risk of losing more than 10 lives from natural disasters in 2025, according to 5 year projections applied to the World Risk Index.

Figure 7

Source: PwC analysis

Countries with largest populations at risk to natural disasters where MBD can make an impact



World of Opportunity

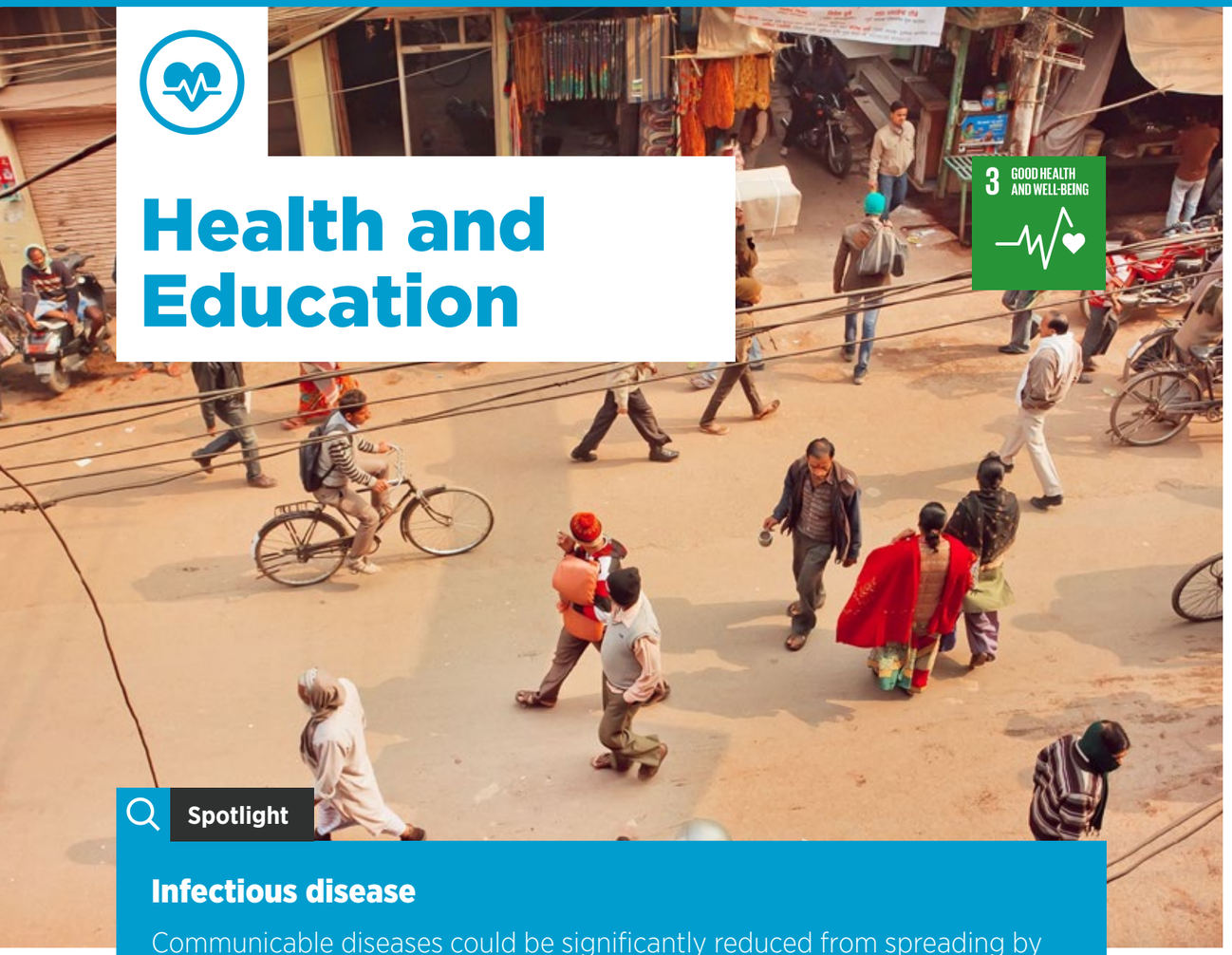
Across the world's most populous at-risk emerging and advanced countries, emergency services which benefit from MBD-enabled insights that help decision makers deploy rescue teams and evacuate populations more efficiently could reduce mortalities from natural disasters by up to 7 per cent as well as significantly reduce injury. These response measures would not only protect and save lives but also reduce damage to assets that are accessible and can be moved from danger zones.

Role of MBD

Location data from mobile subscribers, once aggregated and anonymised, can be combined with other data such as traffic and weather reporting to better understand where populations are most at-risk. Operators with advanced MBD capabilities can provide necessary insights on a near or real-time basis. Consenting car owners provide data such as traffic information probes, hazard lamps and sensors that measure outdoor air temperature, and sensors that monitor water levels and inundation which can be used to predict the risk of natural disasters. When layered with public records, statistics of disaster preparedness, response duties and road use data, emergency services can be empowered to deploy rescue workers towards clear escape routes with greater effectiveness. Emergency response control teams, police and fire and ambulance teams can use the MBD-supported insights to deploy rescue workers more effectively, targeting teams to go where populations are most at-risk.

Reference Case

In Japan, KDDI have collaborated with partners to design an application supporting MBD protocols to address disaster recovery, since Japan is exposed to flood-related natural disasters on a regular basis. Each year, disasters claim dozens of casualties as well as significant losses from damaged assets in flood-prone areas. A key objective for Japan's rescue authorities is to reach the impacted population as quickly as possible, as well as to evacuate victims quickly.



Health and Education

3 GOOD HEALTH AND WELL-BEING

Spotlight

Infectious disease

Communicable diseases could be significantly reduced from spreading by targeting locations at risk of exposure through MBD solutions to understand population movements. This could result in some 650,000 fewer cases of tuberculosis alone in the next five years.

What's at stake

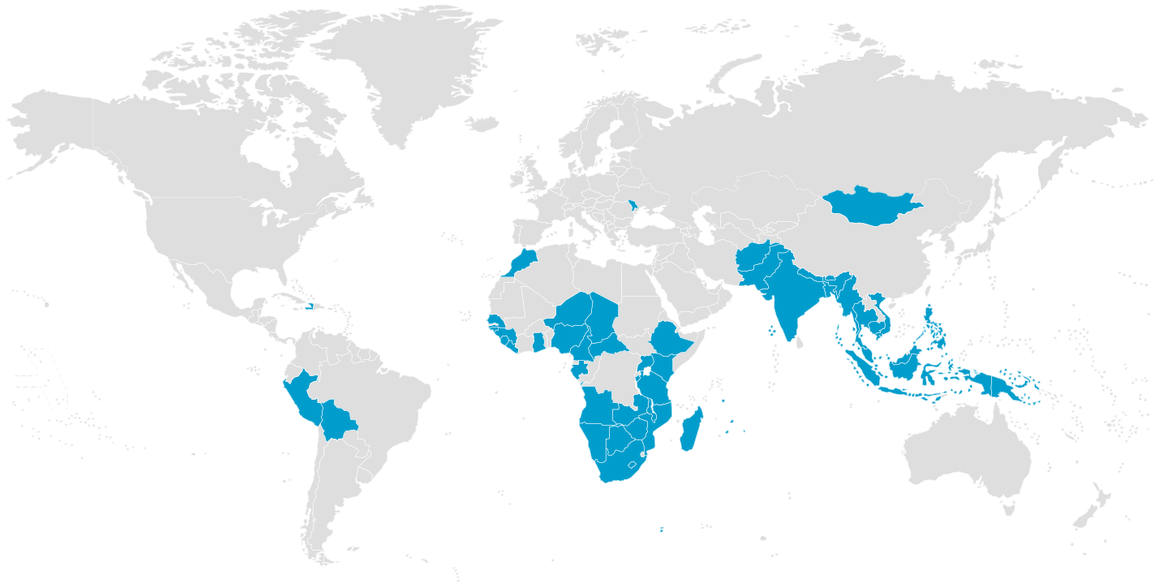
In recent years there have been over 450 million cases of Tuberculosis, Malaria, Dengue, Cholera and Hepatitis B estimated worldwide.[31, 32,33,34,35] Some at-risk nations, such as India, have adopted ambitious targets to wipe out tuberculosis by 2030.

31. Tuberculosis (WHO, 2018). Access: https://www.who.int/news-room/fact-sheets/detail/tuberculosis
32. Dengue and severe dengue (WHO, 2019). Access: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue
33. Cholera (WHO, 2019). Access: https://www.who.int/news-room/fact-sheets/detail/cholera
34. Hepatitis B (WHO, 2019). Access: https://www.who.int/news-room/fact-sheets/detail/hepatitis-b
35. Malaria (WHO, 2019). Access: https://www.who.int/news-room/fact-sheets/detail/malaria

Figure 8

Source: PwC analysis

Countries exposed to tuberculosis that could benefit from MBD enabled insights



World of Opportunity

In the most susceptible countries across Asia and Africa, as shown in Figure 8, targeted prevention, diagnosis and treatment using MBD could reduce an additional 650,000 cases of tuberculosis alone over five years, equivalent to a reduction of over 1 per cent. The ability of MBD to contain the outbreak of tuberculosis could also be applied to a wide range of communicable diseases.[36]

Role of MBD

Mobile location data from subscribers, once aggregated and anonymised, can be used to understand regular population movements such as commuting patterns to work, schools, and other habitual daily journeys. Movement patterns when combined with publicly available data on incidence rates of tuberculosis can be used to identify areas that are at risk of infectious spread. Afterwards, measures of prevention, awareness and better preparing medical practitioners to diagnose and treat patients can reduce the risk of disease spread.

Reference Case

In India, Airtel supported the development of a proof of concept that pinpoints geographic locations at high risk of exposure to tuberculosis. Using the mobile data of approximately 40 million people as well as the expertise of BHBM on tuberculosis and local requirements, areas where anti-tuberculosis measures would be most effective were identified.

36. Such as Malaria, Dengue, Cholera and Hepatitis B.

Citizen Inclusion

10 REDUCED INEQUALITIES

8 DECENT WORK AND ECONOMIC GROWTH

Spotlight

Financial Services

70 million more adults could take up financial services across the 58 countries in Africa, Asia and Latin America where over 40 per cent of adults are unbanked using MBD solutions to target groups to raise awareness, trust and confidence in digital financial services.

What's at stake

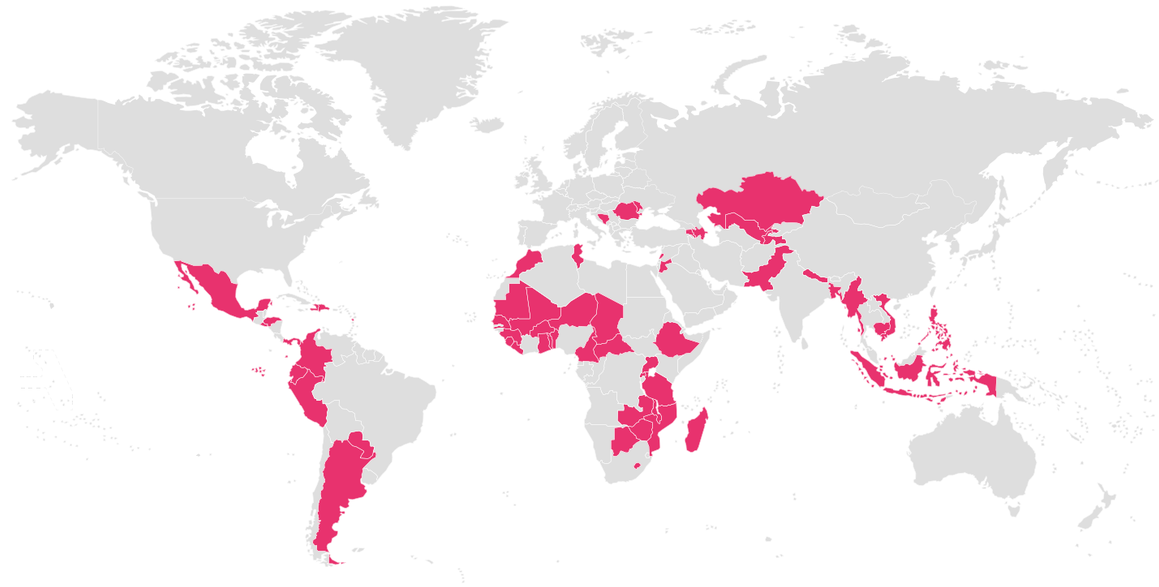
Despite years of financial services innovation, there are still 1.7 billion adults around the world who remain unbanked, that is they are not served by a financial institution or mobile money provider.[37] Although traditional, digital and mobile-enabled financial services exist in many countries, in general uptake remains low among the poor partly due to lack of flexibility, confidence, awareness and trust in such services.

37. The Global Findex Database (2017, World Bank Group). Access: https://globalfindex.worldbank.org/globalfindex/sites/globalfindex/files/overview/211259ov.pdf

Figure 9

Source: PwC analysis

Countries with unbanked adult populations that MBD could better support



World of Opportunity

MBD interventions could support 70 million more adults to use financial services over the next five years. This would be equivalent to a further 8 per cent reduction in the portion of unbanked population in target countries that span Africa, Asia and Latin America, as shown in Figure 9.[38]

Role of MBD

Calling and top-up patterns from mobile networks, once aggregated and anonymised, can provide insights that enable government agencies and financial services project managers better understand how to support the unbanked population by designing education campaigns or widespread communications to enhance public awareness, service quality and flexibility to target the uptake and usage of digital financial services.

Reference Case

Case studies across Ghana, Zambia, Nigeria and Kenya have used MBD and similar techniques to understand the concerns and needs of unbanked populations to support their engagement with digital financial services.[39] Data from these reference case examples have been grouped to illustrate the potential impact if a similar MBD intervention was deployed more widely.

38. These countries have an unbanked adult population of approximately 890 million.
39. These approaches use technology to analyse preferences, desires, and build greater understanding of users to support usage of digital financial services.

Next Steps

Realising the potential of MBD requires implementation by a global cohort of practitioners MBD for Social Impact goes to the heart of today's pressing need for governments and international development agencies to enhance the effectiveness of public initiatives which use scarce and tightly budgeted resources. Leveraging MBD also presents an immediate opportunity to stakeholders under pressure to attain the ambitious UN SDG targets for 2030.

MBD impact will be both direct, where MBD directly impacts policy intervention, such as in the case of location of health centres and indirect, where MBD influences or informs policy design, such as the reduction of air pollution. Significant effort will be required to capture these impacts on the part of government agencies, development organisations and mobile network operators. New ways of working will need to be introduced for harnessing direct impacts into projects, as well as collaboration models needed to introduce MBD into complex policy environments. MBD impact will require workflow redesign in government and development agencies, as well as stimulation of innovation to be undertaken jointly by governments and mobile network operators.

Realising the potential of MBD

places a call to action upon stakeholders to adopt change at a local and global level, through the following steps:

Secure commitment and encourage collaboration

between public organisations, civil society, NGOs, mobile network operators and stakeholders to work together and understand how MBD solutions and capabilities can help solve problems, save lives, enhance project outcomes and reduce cost. This will involve securing commitments to MBD adoption, identifying challenges and barriers to uptake for the use of MBD to create social impact, direct and indirect, as well as encouraging mobile network operators to harness their wider mobile big data efforts to specifically create MBD sets which can be leveraged appropriately for social impact.

Invest in and refine end to end processes in implementing organisations

spanning project identification, design and execution, so that MBD solutions result in integrating insights and creating measurable impacts. This will involve identifying change initiatives in government agencies and development organisations to adopt and use MBD solutions, investing in skills and organisation development and in new ways of working. Organisations will also have to learn how to measure MBD contribution to attaining the UN SDGs for 2030, and embed such measurement approaches into projects and supporting processes for project management.

Design MBD solutions for scale

so that countries and organisations can move quickly from being stimulated by inspiring examples of social impact, to achieving widespread scale through repeatable implementation in different and localised environments and circumstances. This will involve implementing agencies and mobile network operators working with others to build sustainable solutions and scale impact.

Adopt privacy and ethics practices and frameworks

to continue to promote responsible use of data for generating social impact in public projects.

Build sustainable models

for solution development and scaling, so governments, development agencies, execution partners, mobile network operators and other ICT companies can work together to implement MBD solutions which are sustainable over a long period of time and are supported by business models that encourage continued investment and innovation by all parties involved.

Learn more with the GSMA AI for Impact Digital Toolkit
www.gsma.com/aiforimpacttoolkit

The mobile industry purpose is to

Intelligently Connect Everyone and Everything to a Better Future

The UN SDGs were adopted under the Agenda for Sustainable Development, along with aspirational targets to be achieved by 2030. Recognising the potential contribution of mobile technology, the mobile industry made a commitment to support the UN SDGs in 2016. Having connected over 5 billion people to an interconnected global mobile communications network, this commitment to the UN SDGs has refreshed the industry's purpose to connect everyone and everything to a better future. In 2017 the GSMA established the AI for Impact initiative (formerly known as Big Data for Social Good) to accelerate the impact of MBD on social good and bring together mobile operators on this topic. The programme is supported by a Task Force consisting of mobile network operators actively involved in implementing mobile AI for Impact initiatives, as well as an Advisory Panel of wider public sector and development agency stakeholders.[40]

40. Task Force members: Airtel, Hutchison Whampoa, KDDI, Korea Telecom, MTC, Megafon, Millicom, NTT DoCoMo, Orange, SK Telecom, Safaricom, SoftBank, Deutsche Telekom, Telefonica, Telenet, Telenor, Telia, Turkcell, Vodafone and Zain. Advisory Panel members: Data 2X, Dial, GPSDD, Be Healthy Be Mobile, Global Pulse, OCHA, UNDP, UNHCR, Unicef, World Bank Group and World Food Programme.

Appendices

Appendix 1: Methodology

PwC has developed a framework to quantify and translate the impact of MBD research projects across borders to assess global potential. To ensure the framework is widely accessible and easy to apply, the SDGs have been grouped into five themes that outline priority areas where MBD has demonstrated potential or realised impact, which are as follows:

1. Cities, Infrastructure, Economic Growth
2. Climate Change and Environment
3. Managing Disasters
4. Health and Education
5. Citizen Inclusion

Framework development key tasks

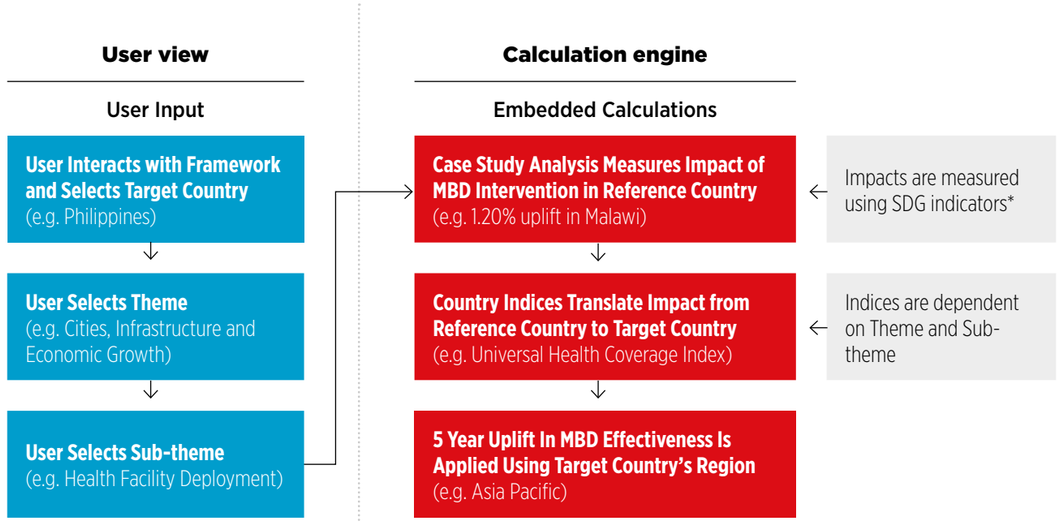
The following steps have been taken to develop the framework:

1. Review the 17 SDGs and their potential grouping
2. Group into coherent public policy themes, consulting with government stakeholders
3. Identify existing GSMA and other relevant use case examples where MBD has been used or is being planned to be used, in use cases linked to any of the five themes
4. Qualify or eliminate case examples selected on the basis of veracity and credibility of information, data collected and evidence publicly available from the case example
5. Undertake selected interviews and consultations with mobile operators developing cases, GSMA executives, and government officials to test and gain deeper insight into cases and potential application
6. Consult with UN SDG and other multilateral and government information sources to establish links between project objectives, outcomes and potential uses of MBD
7. Confirm "reference case" list based on above, for reference case countries for each theme and sub-theme case example confirmed
8. Build a simple input to output model, to create a link between project objectives and outputs influenced by MBD
9. Determine assumptions where appropriate to estimate potential MBD-related impact, citing documented case outcomes where possible or drawing upon expert views to determine best-effort assumptions
10. Identify a simple set of indices from globally documented and credible sources, to apply to the five themes and facilitate calculations to apply reference calculations to "target" countries, so that potential impacts in a target country may be understood
11. Build common indices tables to calibrate impacts based on a country's mobile connectivity quality and big data and analytics capability
12. Apply simple criteria for identifying possible target country sets for a given case example, and assumptions for estimating a 5 year potential impact.

Key development tasks in steps 8 to 11 are captured in the framework design illustrated in Figure 10.[41]

Figure 10 Source: PwC

Framework Work Flow Diagram



**when SDG indicators capture benefits of MBD intervention.*

Social impact measurement

Linkages were made between MBD reference case sub-themes, SDG indicators and goals to assess the social impact of MBD interventions, illustrated in Figure 11. The SDGs offer guidance on how to measure social impact and governments around the world are already basing their policies on them.[42] They include themes ranging from extreme poverty to building sustainable cities to fostering global cooperation. Alternative indicators have been considered where the SDG indicators do not directly capture benefits of MBD interventions. It may also be noted that MBD, in future, could also be harnessed to improve measurement of UN SDG impacts themselves.

41. Appendix 2 includes examples outlining the calculation methodology for the global potential impact.
42. How can we measure real progress on the Sustainable Development Goals? (World Economic Forum, 2018). Access: https://www.weforum.org/agenda/2018/07/how-to-measure-progress-sustainable-development-goals/

Figure 11

Source: PwC

Linkages between framework themes, SDG indicators and goals (illustrative; non-exhaustive)

Framework	Theme	Sub-theme	UN Indicator	UN SDG
Framework	Citizen Inclusion	Financial Services	**8.10.2** Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider	8
		Crime Prevention	**16.1.1** Number of victims of intentional homicide per 100000 population by sex and age	1
		Poverty Reduction	**1.3.1** Proportion of population covered by social protection floors/systems by sex distinguishing children unemployed persons older persons with disabilities pregnant women newborns work-injury victims and the poor and the vulnerable	2
		Food Security	**2.3.2** Average income of small-scale food producers by sex and indigenous status	16
	Managing Disasters	Emergency Response	**13.1.1** Number of deaths missing persons and directly affected persons attributed to disasters per 100000 population	13
		Emergency Displacement	Number of affected persons attributed to disasters receiving relief supplies*	
		Emergency Reconstruction	**1.4.1** Proportion of population living in households with access to basic services	1
	Climate Change and Environment	Air Pollution	**11.6.2** Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)	11
		Climate Migration	Proportion of Internally Displaced Population receiving relocation support*	
		Safe Water	**6.1.1** Proportion of population using safely managed drinking water services	6
	Health and Education	Infectious Disease	Number of people requiring interventions against tuberculosis*	
		School Connectivity	**4.a.1** Proportion of schools with access to (a) electricity; (b) the Internet for pedagogical purposes; (c) computers for pedagogical purposes; (d) adapted infrastructure and materials for students with disabilities; (e) basic drinking water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (as per the WASH indicator definitions)	4
		Ambulance Services	**3.6.1** Death rate due to road traffic injuries	3
	Cities, Infrastructure and Economic Growth	Health Facility Deployment	**3.8.1** Coverage of essential health services	3
		Electricity Access	**7.1.1** Proportion of population with access to electricity	7
		Public Transport	**11.2.1** Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities	11
		Roads and Highways	**9.1.1** Proportion of the rural population who live within 2 km of an all-season road	9

when SDG indicators capture benefits of MBD intervention.

Translating impact across countries

Indices were used to translate potential impact the reference case country to the practitioners home country, national characteristics such as location, geography, size and population characteristics, sophistication of economy and bureaucracy, mobile network infrastructure and mobile adoption, including those indicated in Figure 12.

Figure 12

Source: PwC

Principal indices used to support social impact estimation of MBD

Theme	Sub-theme	Sub-theme Index	All-theme Index
Citizen Inclusion	Financial Inclusion	Commitment to Reducing Inequality,[43]	Mobile Connectivity[44]
Managing Disasters	Emergency Response	World Risk,[45]	
Climate Change and Environment	Air Pollution	Environmental Performance[46]	
Health and Education	Infectious Disease	Human Development[47]	
Cities, Infrastructure, Economic Growth	Health Facility Deployment	Universal Health Coverage of Essential Service[48]	

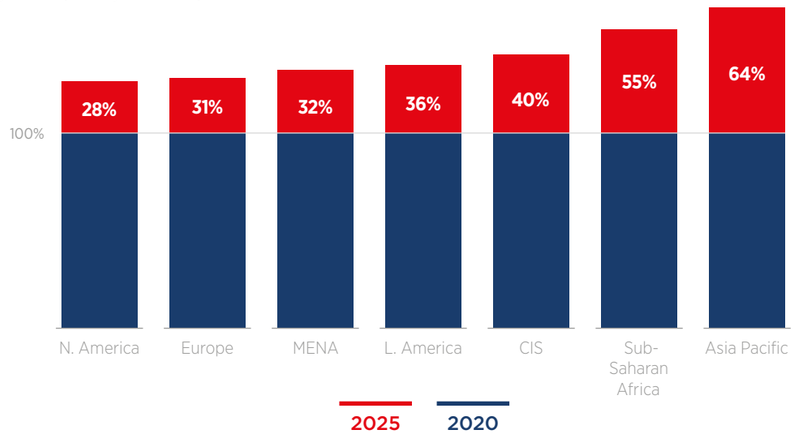
43. The Commitment to Reducing Inequality Index (Oxfam, 2018). Access: https://www.oxfam.org/en/research/commitment-reducing-inequality-index-2018
44. The Mobile Connectivity Index (GSMA, 2019). Access: http://www.mobileconnectivityindex.com/
45. World Risk Index (Alliance Development Works, 2016). Access: https://www.ireus.uni-stuttgart.de/en/institute/world_risk_index/
46. Environmental Performance Index (Yale University, 2019 https://epi.envirocenter.yale.edu/
47. Human Development Index (United Nations, 2018). Access: http://hdr.undp.org/en/content/human-development-index-hdi
48. UHC index of essential service coverage (WHO, 2019). Access: http://apps.who.int/gho/data/node.imr.UHC_INDEX_REPORTED?lang=en

5-year Impact

Relative improvement in analytics capabilities, representing a countries ability to extract value from MBD, has been considered across regions to project a 5 year impact and is shown in Figure 13. Estimations are based on forecasted growth in the global market for Big Data,[49] regionalised using proportional growth in the market for IoT.[50] This forecast takes a conservative approach as it does not consider slight improvements in the coverage of mobile networks, whereby mobile penetration is forecasted to increase from 67 per cent in 2018 to 71 per cent in 2025.[51] We are already seeing improvements in MBD effectiveness beyond what is projected, as only some interventions are using Artificial Intelligence today to inform decision making in high pressure and uncertain situations.[52] Even further advances are looming that show potential to uplift MBD effectiveness, such as deep learning which could transform MBD interventions to unprecedented insight-generating and problem solving capabilities beyond what is observable today.

Figure 12 Source: PwC analysis

MBD Intervention Effectiveness
% Increase by 2025 (base year 2020)



Limitations

Data availability in the environment for MBD interventions is sparse today, therefore calculations supporting the framework are illustrative. To show the hypothetical potential impact a conservative approach has been adopted. Impacts have been considered on a "business as usual" case around development project design, whereas in reality and over time, MBD might result in major changes to how public impact projects are designed altogether, resulting in more fundamental improvements to social impact from such projects. Finally, there are challenges envisioning the full landscape of MBD interventions, as the potential is broad and due to the rapid innovation and development of MBD initiatives over the past decade, "business as usual" cases and their potential impact will likely move beyond what we consider possible today.

49. Big Data Analytics Trends and Forecast (Wikibon, 2018)
50. IoT Revenue Forecast (GSMA Intelligence, 2018)
51. The Mobile Economy (GSMA, 2019). Access: https://www.gsmaintelligence.com/research/?file=b9a6e6202ee1d5f787cfebb95d3639c5&download
52. Case Study: Responding quickly and effectively to disasters in Japan (GSMA, 2019). Access: https://bigdatatoolkit.gsma.com/resources/GSMA-Case-Study_Responding-quickly-and-effectively-to-disasters-in-Japan.pdf

Mobile Big Data Solutions for a Better Future

Appendix 2: Notes to global potential impact headlines

The purpose of this Appendix is to explain how the global potential impact headlines are determined. In each case, a detailed calculation supports the estimation, driven by the method explained in Appendix 1. The emergency response example below is elaborated to a higher degree of detail, to "step through" such a calculation methodically, drawing upon the steps taken to do so. The other global headline examples are also included, in a simplified form, for completeness.

Emergency response

Lives

1. Reference case example is Japan, where MBD can be used to inform emergency response to natural disasters. Drawing upon research that indicates MBD could reduce commute times by 30 to 35 per cent by using up-to-date information to plan their commutes,[53] a conservative assumption is applied that improvement to speed of evacuation is 20 per cent. We assume a linear relationship between speed of evacuation and number of deaths during a natural disaster.
2. The framework's calculation engine applies the reference country impact of 20 per cent in Japan to target countries. In 2018, Japan suffered 225 casualties from the floods. Applying a 20 per cent improvement in the speed of evacuation, achieved through the use of MBD which results in improved rescue times, 45 additional lives would have been saved.
3. The in-year impact is calculated by comparing Japan in the 2018 floods to the target countries around the world that this might apply to, of which there are 55. These are countries which demonstrate a similar or higher exposure to risk of natural disaster as does Japan, according to the World Risk Index.
4. These 55 countries each have a unique ranking when it comes to their position in the World Risk Index, as well as their relative score on Mobile Connectivity, as well as their unique growth trajectory in Mobile Big Data effectiveness (see 5 year impact diagram in Appendix 1).
5. Applying these elements into an indexed formula, and comparing to Japan as a reference country, our calculation determines that where Japan would have some 45 lives saved in a 2018 flood, these 55 countries would save around 2x such lives, per country, per annum.
6. A driving factor for why on average the 55 countries might expect 2x lives saved per year of disasters compared to Japan is due to some countries having higher population sizes with an exposure to potential disaster.
7. By 2025, the potential lives saved, across all 55 countries combined, would total around 25,000 lives.[54]
8. Potential injury prevention or reduction is not calculated for the case examples. Reference case example from Japan records 432 casualties in the 2017 Japan floods; injury data was not available for 2018 floods.

53. Connected Life (GSMA, 2013). Access: https://www.gsma.com/iot/wp-content/uploads/2013/02/GSMA-Connected-Life-PwC_Feb-2013.pdf
54. Natural Disasters (Our World in Data). Access: https://ourworldindata.org/natural-disasters

Damage

1. Reference case example is Japan, where MBD can be used to inform emergency response to natural disasters. Drawing upon data from the 2018 Japan floods, where asset damage amounted to $9.86 billion.[55] The model has assumed that 10 per cent of assets by value are movable, 50 per cent of movable assets are accessible, and 20 per cent of movable and accessible assets are moved during emergency response. Therefore, conservatively, 1 per cent or US$96.8m of total assets are considered to be relevant.
2. The framework's calculation engine applies the reference country impact of US$96.8m in Japan to target countries.[56]
3. The in-year impact is calculated by comparing the reference country to the target country using the theme and sub-theme indices to determine the availability of MBD in each country as well as current capacity in the country to resolve the sub-theme issue:
    - **Theme:** Managing Disasters
    - **Sub-theme:** Emergency Response
4. The five year potential impact is estimated by applying a regionalised growth factor to the evolution of Big Data capability in each of the target countries.
5. Reference case example from Japan records USD 1.85bn asset damage in the 2017 floods.

Health Facility Deployment

Coverage

1. Reference case example is Malawi where the case study estimates that 226,000 additional people, representing 1.20 per cent of Malawi's 18.6 million population, could have access to health facilities based on more informed site planning.[57,58]
2. The framework's calculation engine applies the reference country impact of 1.20 per cent in Malawi to target countries.
3. Countries have been selected in which the sub-theme applies, in other words currently having low levels of universal health coverage (i.e. a score less than 60).[59]
4. The impact is calculated by comparing the reference country to the target country using the theme and sub-theme indices to determine the availability of MBD in each country as well as currently capacity in the country to resolve the sub-theme issue:
    - **Theme:** Cities, Infrastructure and Economic Growth
    - **Sub-theme:** Health Facility deployment

55. West Japan torrential damage of 1,940.0 billion yen (Ashai, 2018) Access: https://www.asahi.com/articles/ASL9X54P7L9XUTIL036.html
56. The calculation assumes a natural disaster of comparable size occurs across relevant output countries.
57. Health Facility Deployment in Malawi (Digital Impact Alliance initiative, 2019)
58. Calculation assumes a project of comparable size occurs across relevant output countries and the optimised result is proportional to that expected in Malawi
59. UHC index of essential service coverage (WHO). Access: http://apps.who.int/gho/data/node.imr.UHC_INDEX_REPORTED?lang=en

Spending

1. Reference case example is Malawi where the case study estimates that 226,000 more people on top of 9.3 million people in which coverage is extending, could have access to health facilities from more informed site planning, representing an increase in efficiency of 2.47 per cent when the outcome is compared to the traditional approach.[60,61]
2. The framework's calculation engine applies the reference country impact of 2.47 per cent in Malawi to target countries.
3. Countries have been selected in which the sub-theme applies, in other words currently having low levels of universal health coverage (i.e. a score less than 60). [62]
4. Public capital expenditure on health infrastructure across countries has been considered.
5. The impact is calculated by comparing the reference country to the target country using the theme and sub-theme indices to determine the availability of MBD in each country as well as currently capacity in the country to resolve the sub-theme issue:
    - **Theme:** Cities, Infrastructure and Economic Growth
    - **Sub-theme:** Health Facility deployment
6. The output has then been multiplied on public capital expenditure on health infrastructure across target countries.

Air Pollution

1. Reference case example is Brazil where MBD could be used to inform traffic restrictions in major city centers. Drawing upon the average reduction in traffic from major cities currently implementing traffic restrictions of 20 per cent and the contribution of tailpipe emissions to PM2.5[63] levels of 30 per cent, it is estimated that MBD can be used to improve air pollution levels by approximately 6 per cent.[64]
2. The framework's calculation engine applies the reference country impact of 6 per cent in Brazil to target countries.
3. Countries have been selected in which the sub-theme applies, in other words, major cities currently experiencing air pollution levels exceeding WHO guidelines.
4. The five year potential impact is estimated by applying a regionalised growth factor to projected improvement in effectiveness of MBD interventions in each of the target countries
    - The in-year impact is calculated by comparing the reference country to the target country using the theme and sub-theme indices to determine the availability of MBD in each country as well as currently capacity in the country to resolve the sub-theme issue:
        - **Theme:** Climate Change and Environment
        - **Sub-theme:** Air Pollution

60. Health Facility Deployment in Malawi (Digital Impact Alliance initiative, 2019)
61. Calculation assumes a project of comparable size occurs across relevant output countries and the optimised result is proportional to that expected in Malawi
62. UHC index of essential service coverage (WHO). Access: http://apps.who.int/gho/data/node.imr.UHC_INDEX_REPORTED?lang=en
63. Impacts of NO2 on air pollution and health have been excluded from this calculation.
64. What are the effects on health of transport-related air pollution? (WHO). Access: http://www.euro.who.int/en/data-and-evidence/evidence-informed-policy-making/publications/hen-summaries-of-network-members-reports/what-are-the-effects-on-health-of-transport-related-air-pollution

Infectious disease

1. Reference case example is India, where MBD can be used to inform more targeted prevention of the outbreak of tuberculosis, reducing the number of incidences by up to 3,500 or 1.35 per cent of the total 260,000 reported in Uttar Pradesh.[65,66]
2. The framework's calculation engine applies the reference country impact of 1.35 per cent in India to target countries.
3. Countries have been selected in which the sub-theme applies, in other words countries which currently have high instances of tuberculosis.[67]
4. The in-year impact is calculated by comparing the reference country to the target country using the theme and sub-theme indices to determine the availability of MBD in each country as well as current capacity in the country to resolve the sub-theme issue:
    - **Theme:** Health and Education
    - **Sub-theme:** Infectious Disease
5. The five year potential impact is estimated by applying a regionalised growth factor to the evolution of Big Data capability in each of the target countries.

Financial services

1. Reference case examples draw from initiatives in Ghana, Zambia, Nigeria and Kenya where case research indicates that targeted marketing from better understanding customers' needs can stimulate uptake of mobile financial services by on average 1.83 per cent.[68] In Ghana, MBD has been used to better understand customers' needs leading to targeting marketing that resulted in uptake of financial services by 1.75 per cent.[69]
2. The framework's calculation engine applies the reference country impact of 1.83 per cent across Ghana, Zambia, Nigeria and Kenya to target countries.
3. Countries have been selected in which the sub-theme applies, in other words countries which currently have an unbanked adult population greater than 40 per cent,[70] while considering relative mobile penetration of unbanked adult population.
4. The in-year impact is calculated by comparing the reference country to the target country using the theme and sub-theme indices to determine the availability of MBD in each country as well as current capacity in the country to resolve the sub-theme issue:
    - **Theme:** Citizen Inclusion
    - **Sub-theme:** Financial Services
5. The five year potential impact is estimated by applying a regionalised growth factor to the evolution of Big Data capability in each of the target countries

Estimation of global positive impact, across all themes

This report has expressed that "Over 150 million people across advanced and emerging countries could be positively impacted by the beneficial impacts of MBD solutions on projects within the next five years."

Estimation approach: MBD interventions across the SDG themes examined have shown that there is potential of a greater than 3 per cent impact on project effectiveness to impact affected populations. Assuming that the projects implemented under the framework themes touch 5 billion population (i.e. approximately 70 per cent of world population), this implies that MBD-enabled interventions may impact the lives of some 150m people.

65. Helping end Tuberculosis in India by 2025 (GSMA, 2018). Access: https://bigdatatoolkit.gsma.com/resources/Big-Data-for-Social-Good_Airtel-INDIA_TB_Case_Study.pdf
66. TB Statistics India (TB Facts, 2016). Access: https://www.tbfacts.org/tb-statistics-india/
67. Incidence of tuberculosis per 100,000 people (World Bank, 2019). Access: https://data.worldbank.org/indicator/SH.TBS.INCD
68. Case study initiatives aim to improve flexibility and service quality for digital financial users to support usage.
69. Big Data for Financial Inclusion (World Bank). Access: https://olc.worldbank.org/system/files/WBG_BD_CS_FinancialInclusion.pdf
70. Account ownership at a financial institution or with a mobile-money-service provider (World Bank, 2019). Access: https://data.worldbank.org/indicator/FX.OWN.TOTL.ZS

gsma.com/betterfuture/aiforimpact
#AI4Impact

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

GSMA HEAD OFFICE
Floor 2
The Walbrook Building
25 Walbrook
London EC4N 8AF
United Kingdom
Tel: +44 (0)20 7356 0600
Fax: +44 (0)20 7356 0601