# LEVERAGING POPULATION MOBILITY INSIGHTS FROM MOBILE OPERATOR DATA FOR DEVELOPMENT AND HUMANITARIAN ACTION: FROM SETTING UP MOBILE DATA PARTNERSHIPS AND SECURE PROCESSING AND DATA IN USE

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## ABSTRACT

### Introduction
Exploring the potential for digital transformation globally, through the use of data initiatives, Flowminder works to promote positive change in both global learning and big data applications, with a strong focus on mobile operator data analytics. Enabling decision makers to access the data needed to transform the lives of vulnerable people, Flowminder focusses on providing valuable insights and capacity strengthening to governments, mobile network operators (MNOs), national/international agencies and researchers, in low- and middle- income countries, to improve decision-making for development and humanitarian purposes.

Currently, understanding and awareness of the value of mobile operator data (and specifically Call Detail Records (CDRs), a dataset automatically generated by MNOs for billing purposes) is significantly increasing; however, the effort required to set up sustainable & impactful CDR data initiatives is not necessarily widely appreciated. Flowminder has been active in assisting governments (as well as development and humanitarian actors) in responding to the need to adopt new data sources in order to fill 'data gaps' and meet their development goals or programme objectives.

Significant during the COVID-19 pandemic, Flowminder proactively supported the global response to the outbreak by working with MNOs, and/or governments to provide, in many countries, mobility insights derived from CDRs, to support decision-making. This proved useful in monitoring the restricted population's mobility through high spatial and temporal resolution, providing near-real time insights which estimated the impact on mobility of imposed restrictions, such as lockdowns, which were implemented to reduce transmission and control the spread of the disease.

**Data and Methods**

To provide decision makers with precise and accurate mobility estimates, and support interventions in many sectors, from health to disaster management or official statistics, for example, Flowminder has developed state-of-the-art methods for estimating population distribution and mobility, alongside different models for setting up public-private big data initiatives.

Extracting the population mobility information contained in CDRs is of critical importance in data poor contexts such as in low- and middle-income countries (LMICs), where it can support humanitarian and human development efforts. Flowminder has specialised in addressing such challenges through the development of robust live systems, from ingestion and automated quality assurance (QA) checks of pseudonymised CDR data and cell data, to the extraction of mobility information from CDRs and bias correction using survey data, resulting in the semi-automated production of a set of standard indicators, ready to be disseminated to decision makers in LMICs through dashboards, standard reports or as data sheets.

Flowminder made the choice to conduct all CDR data processing within the firewall of the MNOs. While this comes with constraints on compute power and memory, it is essential to protect subscribers' data privacy. The organisation has also developed and is testing different models for setting up mobile data initiatives to overcome these challenges, bearing in mind that every operator, context and needs are unique. In Haiti for example, Flowminder is enabling the increased access to and use of mobile operator data in ways that are ethically sound, financially viable, and sustainable, while providing the MNO with CSR and revenue generation opportunities. In Ghana, Flowminder has entered a long-standing partnership with Ghana Statistical Service and Telecel Ghana (previously Vodafone Ghana) to integrate CDR-derived estimates into official statistics, and support branches of the government in using these data for improved decision-making.

To handle all data processing, from ingesting the pseudonymised CDRs to outputting mobility and population estimates, Flowminder built "FlowKit". FlowKit is an open-source CDR data processing toolkit, consisting of various databases and tools for automating data ingestion and QA, implementations of our methods for extracting mobility information from CDRs, scaling, combining and formatting the mobility estimates for end usage. Pseudonymised CDR data are received from the operator daily, and are automatically ingested into the FlowKit database, ready for processing. The team has also set up a monitoring system that tracks the status of the at-MNO servers, FlowKit installations and automated QA checks, and sends alerts so that any detected problem can be addressed quickly. This is important particularly for crisis preparedness so that CDRs are available and specific processing can begin promptly if a crisis occurs or is forecast.

**Results/ Findings**

Flowminder provides analytical reports and data (via datasheets or dashboards) to inform a range of applications, from disaster management, to official migration statistics and immunisation planning, and is working towards further automating the production of these end products for each application. Currently, they produce scaled and adjusted mobility and population estimates for Haiti, Ghana and the Democratic Republic of the Congo (DRC), and the work is backed-up by capacity building activities with key actors for sustainable use.

In response to the COVID-19 pandemic for example, Flowminder provided analyses in seven different countries, utilising anonymised CDR aggregates. They were able to generate insights into the changes of mobility and population distributions, in comparison to a pre-pandemic baseline. Findings from the data research shows a substantial, sharp reduction in mobility immediately following government restrictions in all seven countries, which may have helped control the spread of the disease as intended. However, the data also portrayed that the lifting of restrictions consequently resulted in slow recovery of mobility towards the pre-pandemic baseline, further suggesting a longer term impact of mobility on the economy.

**Research Implications/ Contributions**

Through understanding that every operator, context and needs are unique, and through the development of innovative and robust methods for analysing such data, Flowminder is efficient in supporting decision makers with useful insights into both routine and crisis mobility in a country. However, several challenges are currently preventing operators from routinely providing access to their data for development/humanitarian purposes, including, among others, the lack of resources or financial incentives to process, share and manage data releases over the long term. Therefore, Flowminder aims to openly share the lessons learnt and the knowledge acquired to forge a long-lasting CDR data partnership, from partnership building stage to processing, analysis and applications development.

**Keywords**: public-private partnerships; collaborations; mobile operator data; big data applications