

The Gambia

The hidden potential of CDR data

September 2020

Logo 1

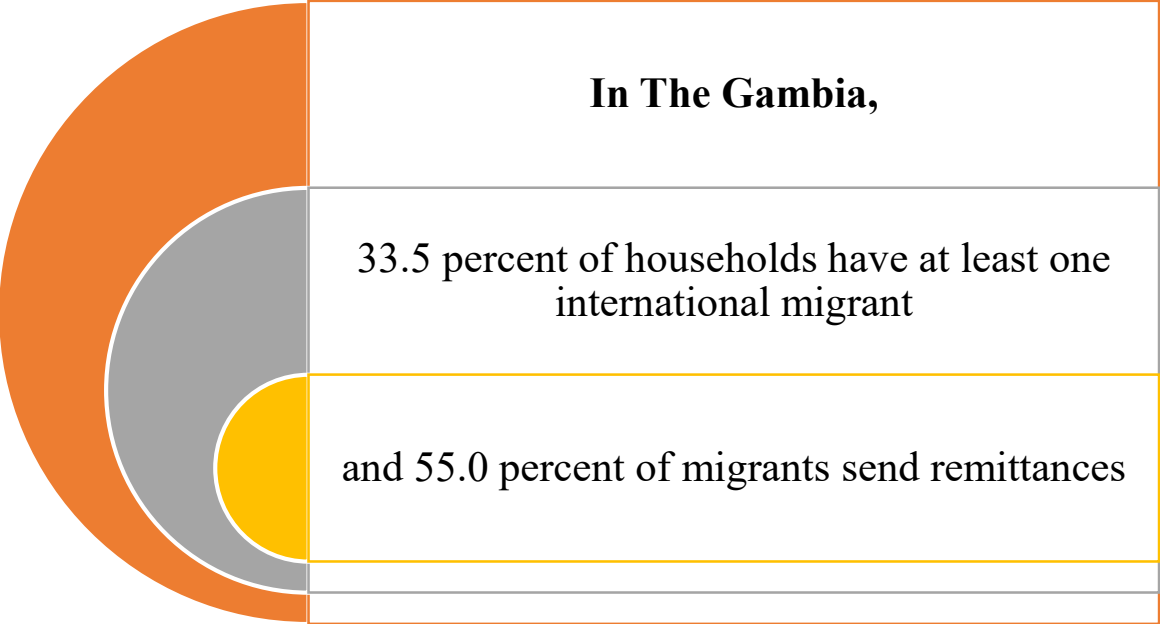
Logo 2

Logo 3



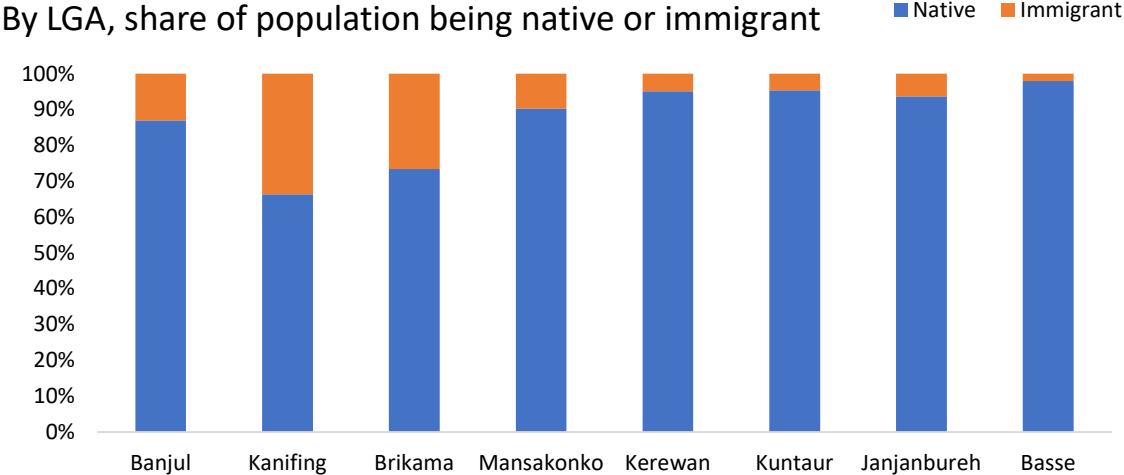
In The Gambia, CDR data analysis can inform discussion on mobility, human mobility and rapid urban development

Stylized fact 1: One in three households have an international migrant ... yet, it remains unclear how migration and remittances evolve over time and how they differ across the country.



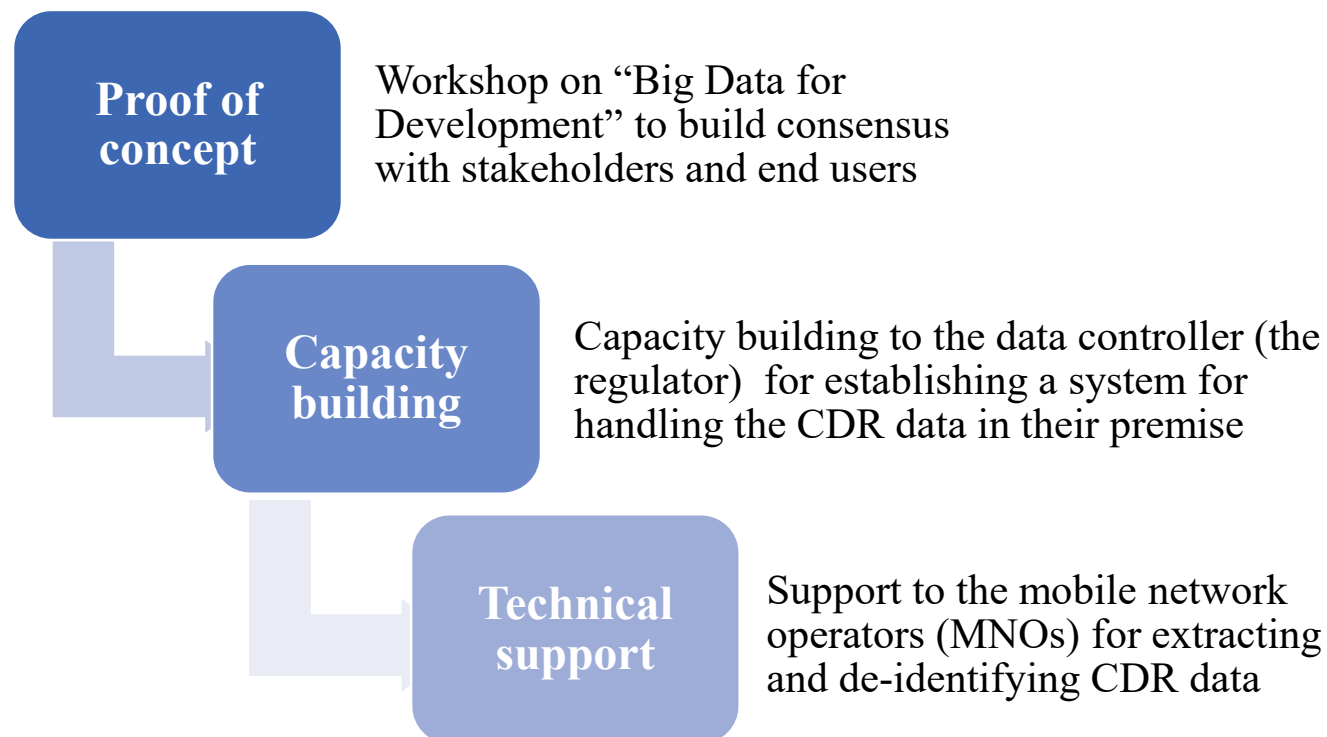
Source: World Bank Migration Survey, The Gambia, 2019.

Stylized fact 2: Better economic opportunities and access to services are pull factors for internal migration ... but lack of timely and spatially aggregated data complicates policy response.



Source: The Gambia Population Census, 2013.

Engagement model for the use of big data in The Gambia: ownership, capacity, and sustainability



Ownership

- Big Data is not owned by traditional partners of National Statistical System (private sector)

Capacity

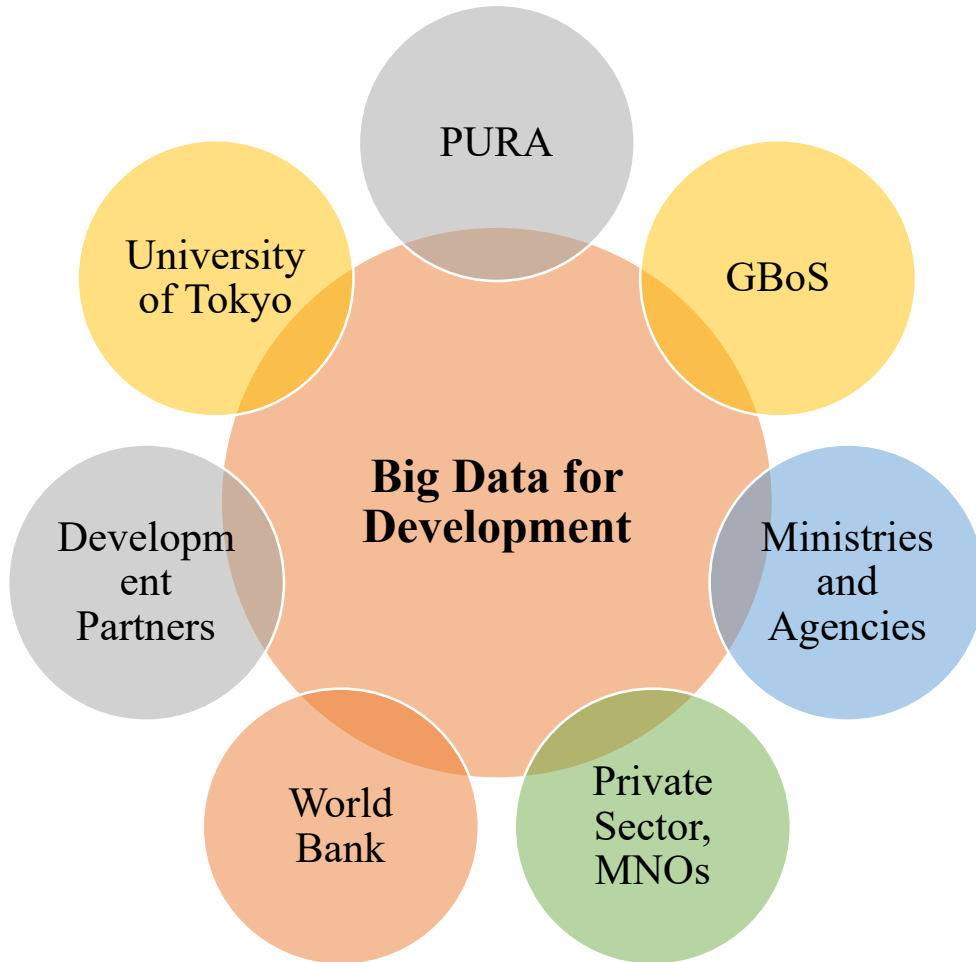
- CDR data is highly confidential
- CDR data is technically complex

Sustainability

- New CDR data becomes available every single second; hence, importance of country systems

Contributing Team: Big Data for Development in The Gambia

The Gambia



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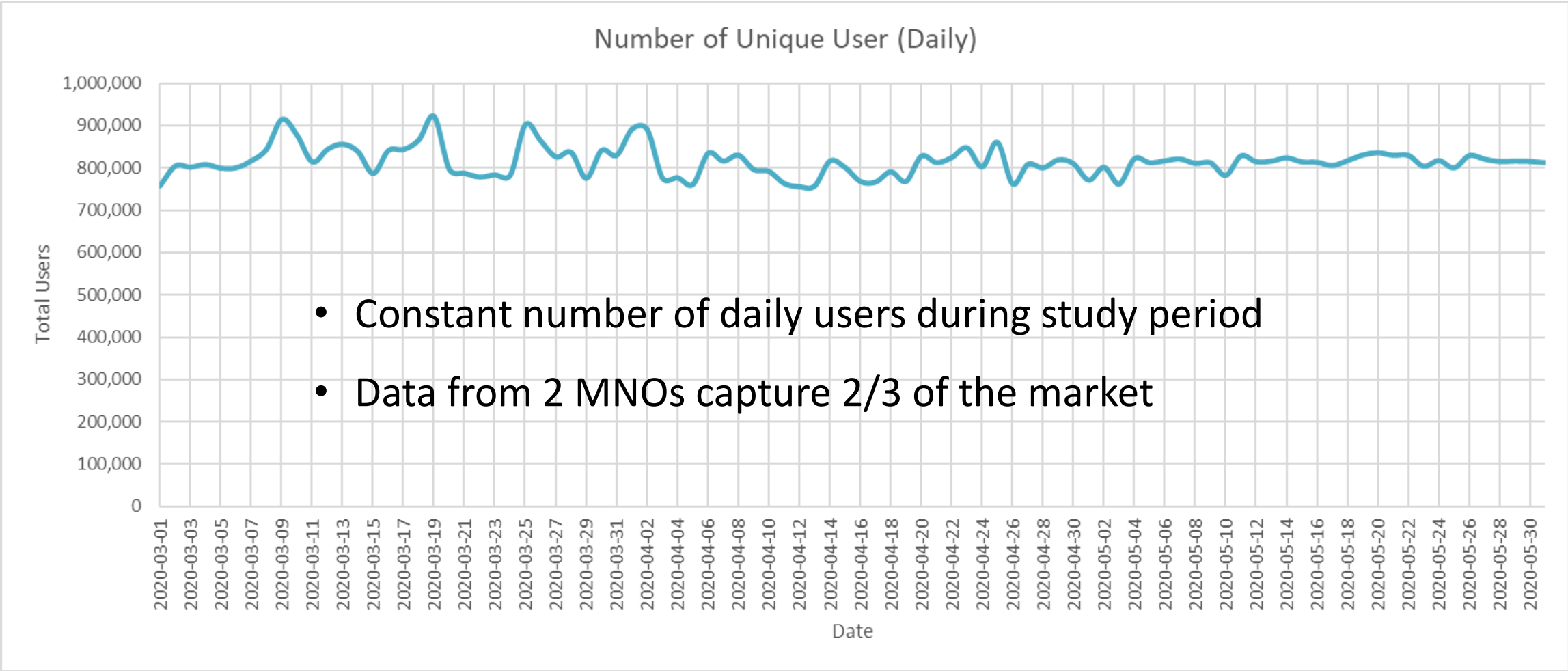
Market share of MNOs and subscribers in The Gambia

- Penetration rate: 143 % (2020)
- # of subscribers: 2,584,714 (2020)

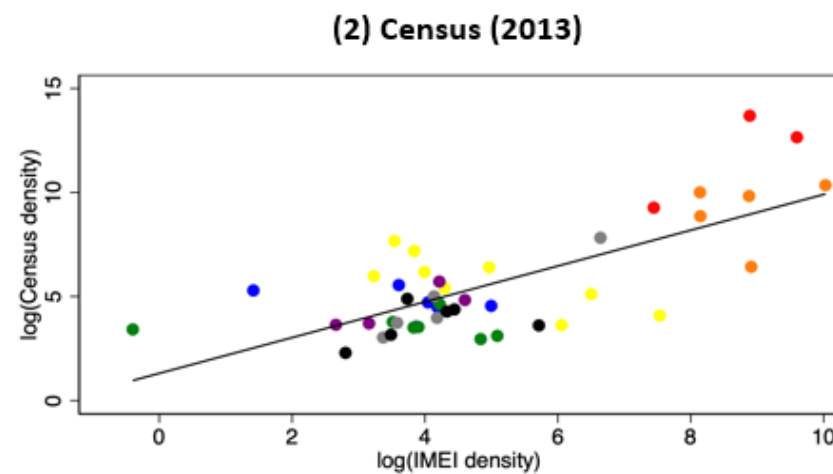
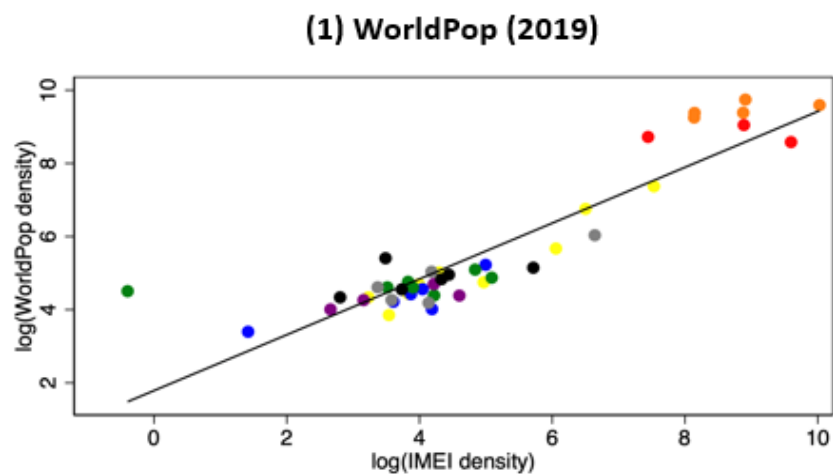
	Market share (%) (# of subscribers)	
Africell	60% (1,557,004)	<ul style="list-style-type: none"> • The largest market share with the widest network coverage
Qcell	26 % (676,739)	<ul style="list-style-type: none"> • Wider network coverage in rural areas
Comium	8% (194,909)	<ul style="list-style-type: none"> • Only voice and SMS (2G) • Popular in rural areas • People in urban areas also use to communicate with families in villages (A dual/multi SIM device is quite common)
Gamcel	6% (156,062)	<ul style="list-style-type: none"> • Originally state-owned

CDR statistics: total unique users

MIN	MAX	AVG	Total Unique ID
756,611.00	921,461.00	815,523.79	2,039,375.00



Validation of CDR data against known population density



- Banjul
- Kanifing
- Brikama
- Masakonko
- Kerewan
- Kuntaur
- Janjanbure
- Basse

	(1) Log (WorldPop density)	(2) Log (Census density)
Log (IMEI density)	0.763*** (14.44)	0.860*** (6.92)
Constant	1.788*** (6.26)	1.309* (1.95)
R ²	0.829	0.527
N of observations	45	45

t-statistics in parentheses

*, ** and *** indicate p<.10, <.05 and p<.01, respectively

Source: World Bank Migration Survey, The Gambia, 2019.

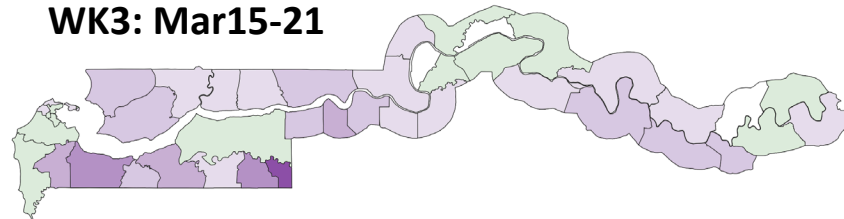
Source: The Gambia Population Census, 2013.

Timeline

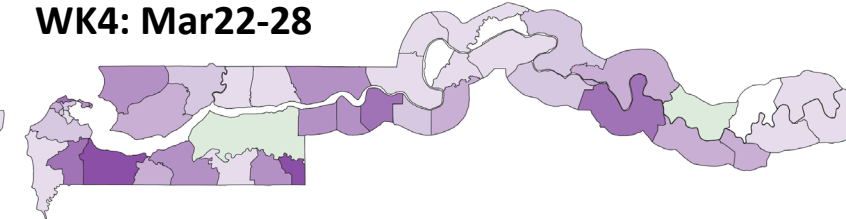
Mar 1 WK1	Mar 8 WK2	Mar 15 WK3	Mar 22 WK4	Mar 29 WK5	Apr 5 WK6	Apr 12 WK7	Apr 19 WK8	Apr 26 WK9	May 3 WK10	May 10 WK11	May 17 WK12	May 24 WK13
<p>Average of WK1 & WK 2: Used as the baseline to examine % changes</p>		<ul style="list-style-type: none"> ● WK6: Good Friday (Apr 10) ● WK7: Easter Monday (Apr 13) ● WK8-12: Ramadan (Apr 23 – Mar 23) 										
		<ul style="list-style-type: none"> ● WK3: Mobility restrictions (Mar 18 – Apr 7) 		<ul style="list-style-type: none"> ● WK4: A state of emergency (Mar 27) ● WK4: Border closed (Mar 23) 		<ul style="list-style-type: none"> ● WK5: A state of emergency extended (Apr 3) 			<ul style="list-style-type: none"> ● WK12: A state of emergency extended (May 19) 			

Case study 1 – Change in inflow due to Covid-19

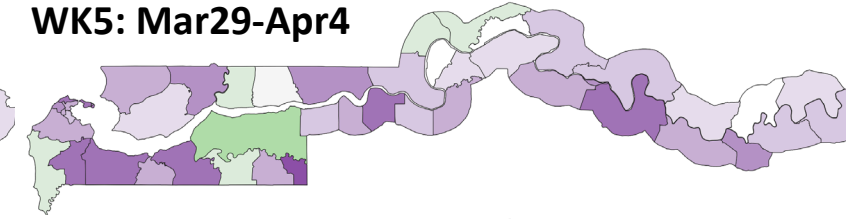
WK3: Mar15-21



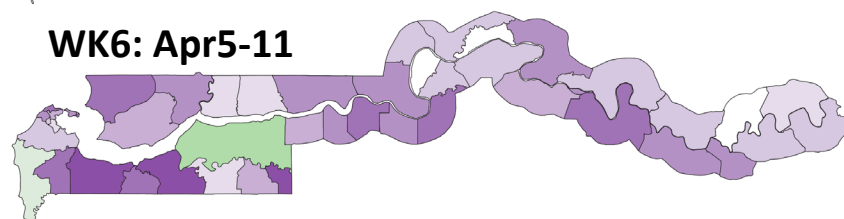
WK4: Mar22-28



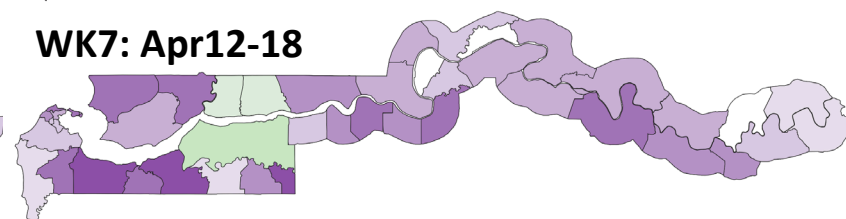
WK5: Mar29-Apr4



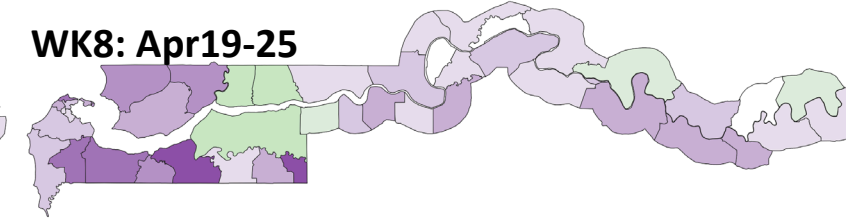
WK6: Apr5-11



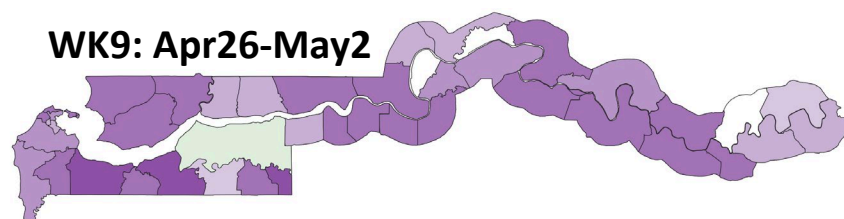
WK7: Apr12-18



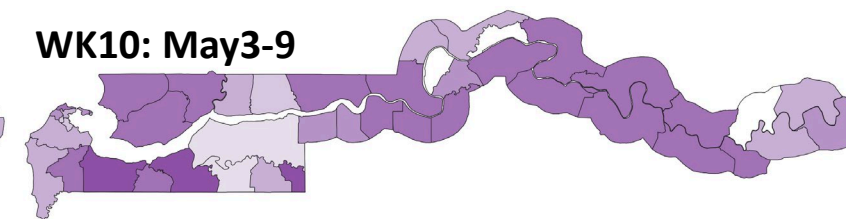
WK8: Apr19-25



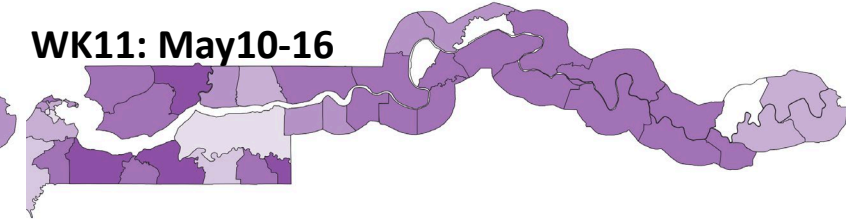
WK9: Apr26-May2



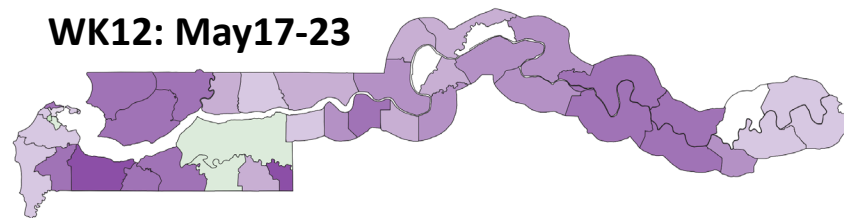
WK10: May3-9



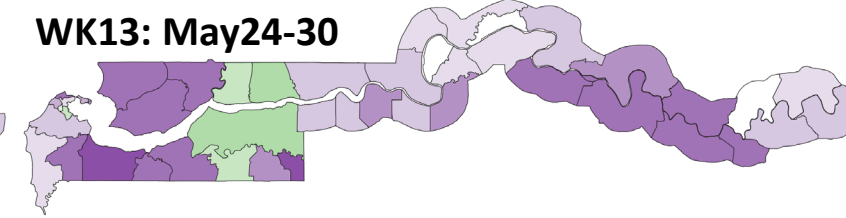
WK11: May10-16



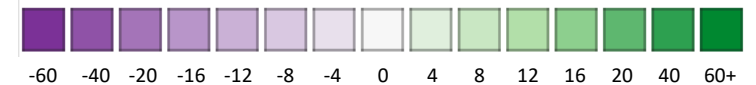
WK12: May17-23



WK13: May24-30



Changes (%)



Case study 2 – population distribution : CDR data to identify hotspots of international migration

Key findings

Share of international calls (incoming) matches concentration of households with emigrants

Data available on a highly localized level and with high frequency

Figure 1: Telecommunication data, incoming calls

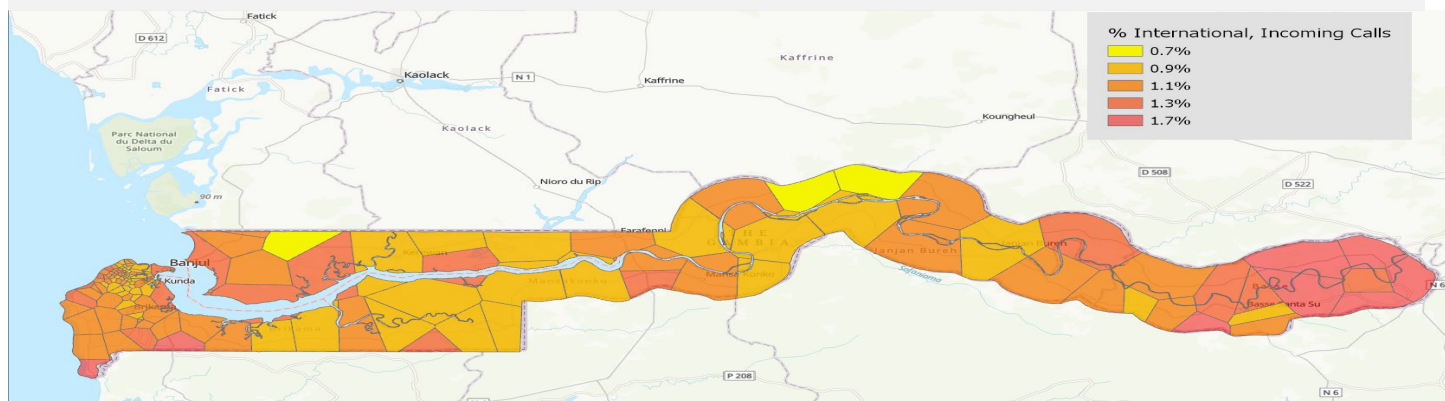
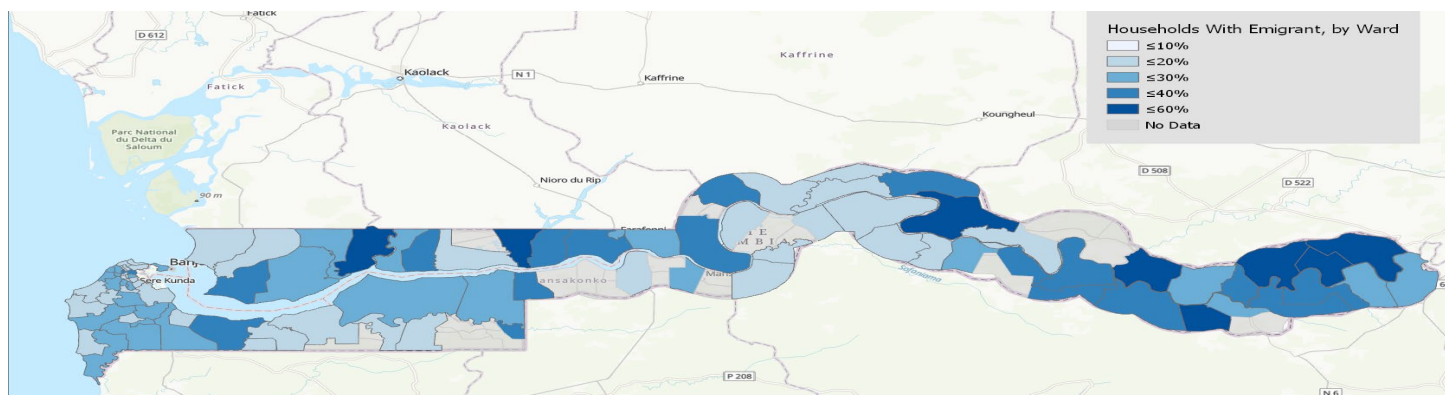


Figure 2: Listing Migration Survey, households with emigrants by ward



APPENDIX

1. Examples of CDR data in action
2. CDR data at the World Bank
3. Gambia CDR data for analysis

Displacement and Disaster Statistics Subgroup

UN GWG on Big Data Task Team on Mobile Phone Data

Members

Flowminder, IOM, ITU, Positium, Pulse Lab Jakarta, Telenor Research, University of Tokyo, World Bank

Contents of Displacement and Disaster Statistics Handbook

- Definition and existing displacement and disaster statistics
- Methodologies and standards extracted from use cases
 - Data and modality of data access
 - Methodologies to produce statistical products
 - Potential architecture of analytical pipeline
 - Validation data
- Guidance to potential readers

Cases Introduce in the Handbook

Natural disasters

- Haiti earthquake 2010
- Japan earthquake and tsunami 2011
- Nepal earthquake 2015
- Haiti hurricane Matthew 2016
- Indonesia earthquake 2018
- Vanuatu volcanos

Epidemics

- Haiti cholera epidemic 2010
- West African Ebola virus epidemic 2013-17
- COVID-19 2020

Methodologies and analytical tools for extracting mobility metrics/statistics

- FlowKit ([Github](#))
- Flowminder COVID-19 Resources ([website](#))
- World Bank COVID19 Mobility Task Force ([Github](#)) and more...

CDR data contains important information about human mobility

Population distribution

Daytime population

Night-time population

Population seasonality

Mobility pattern

Number of trips

Travel distance

Radius of gyration

Trajectory

Origin-destination matrix

Cell-tower-level migration

Interpolated trajectories

The visualization of CDR data shows population distribution, mobility pattern and trajectories

Figure 1: Population distribution

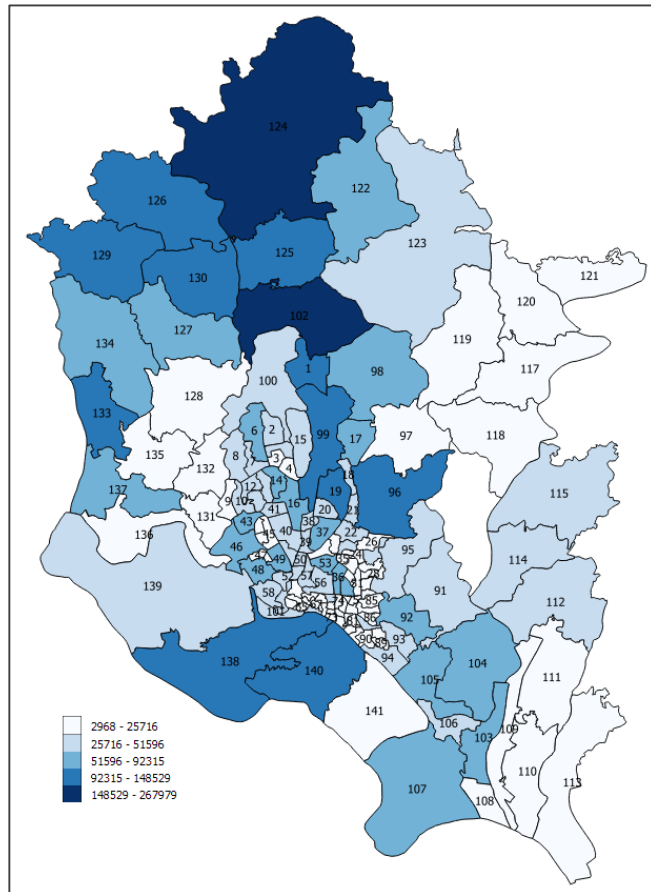
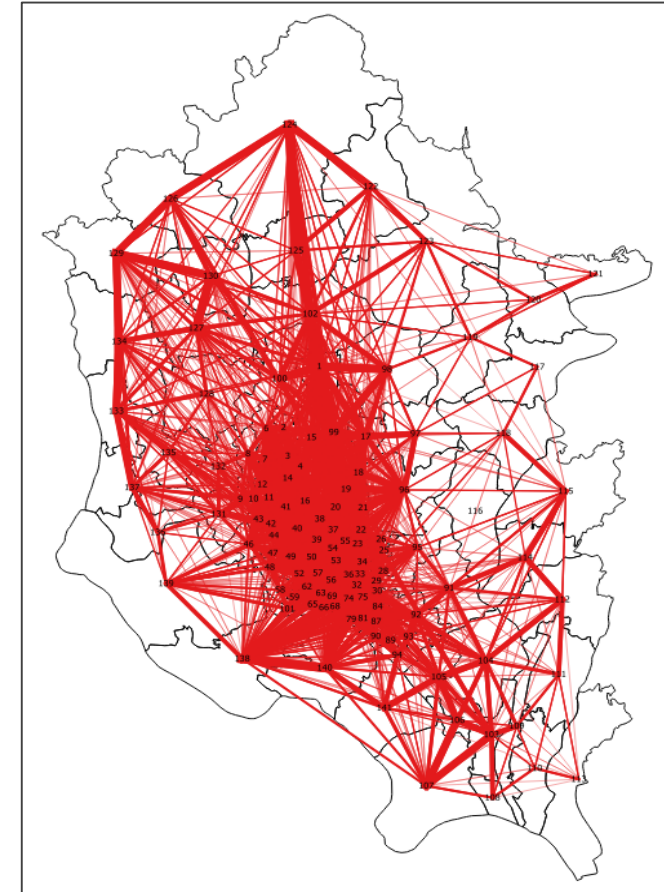


Figure 2: Interpolated trajectories



Figure 3: Trip distribution



In the context of COVID19, just in time information on population distribution and mobility patterns save lives

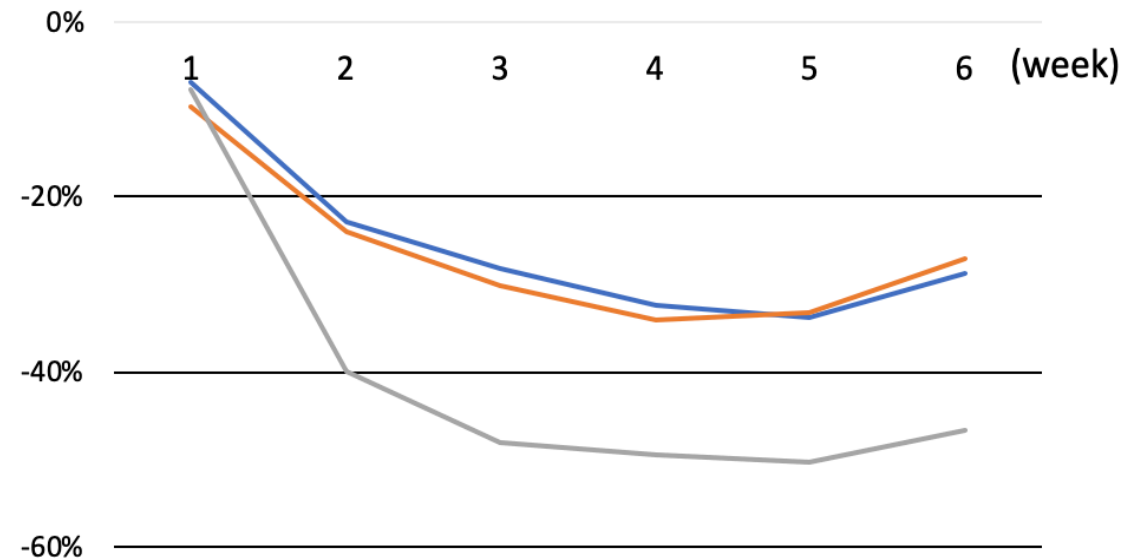
Population distribution

- Headcounts of subscribers during the daytime and night-time at district level
- Headcounts of subscribers who are away from home during the daytime

Mobility pattern

- Inter-district ODs of all subscribers
- Median travel distance at the district level
- Average radius of gyration at the district level

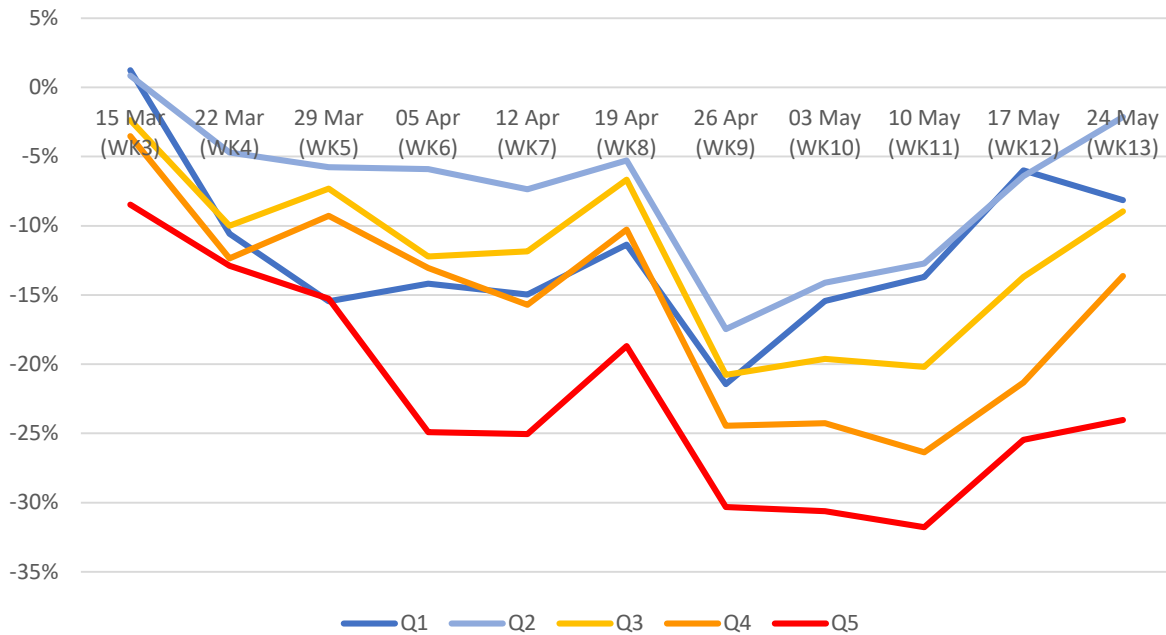
Figure 1: Decreases of population inflows after the intervention (computed from indicators)



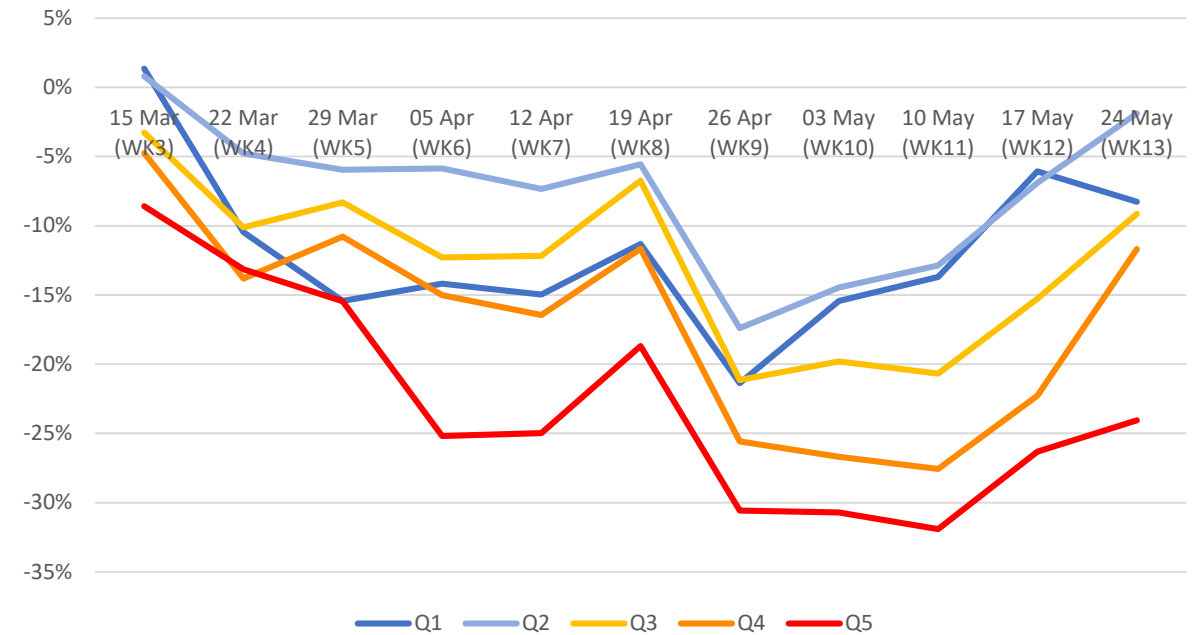
% changes of population outflow to/inflow from other Wards by poverty quintile

The poorer, the more significant decreases in outflows & inflows.

Outflow to other Wards (based on origin)



Inflow from other Wards (based on destination)



Access to CDR data in World Bank Priority Countries

Country	Cell Phone Data	
Afghanistan	Historical	
Argentina	Grandata – dashboard	
Dem. Rep. of the Congo	WB: DIAL; Flowminder	
The Gambia	WB and University of Tokyo	
Ghana	Flowminder	
Haiti	Flowminder	
India	WB with Airtel	
Kenya	WB with Safaricom	
Mozambique	WB and University of Tokyo	
Senegal	WB with Orange/OPAL, Flowminder	
Sri Lanka	DataPop Alliane; WB and University of Tokyo	