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Human Development - Data Science

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Annotated Bibliography (Word Count: 1929 words)

1st ed., Flowminder Foundation, 2021, pp. 1–5, *Population Movements Estimated with Mobile Operator Data from Digicel Haiti: Report from 20 August.* Accessed 21 Sep. 2021. Throughout the credible and detailed data report, Flowminder, in collaboration with Digicel Haiti, shows the results generated from a set of preliminary analyses following the devastating earthquake on August 14th, 2021. Using mobile operator geospatial data and the data science method of clustering, the organizations have been able to track population density and mobility after the earthquake in Haiti, a small island nation in the Hispañola area of the Caribbean. Through aggregated sampling and "calculating the number of subscribers who made or received a call per cell tower cluster" (Population 2), the report was able to focus on two major ideas implied by the data.

Most importantly, when tragedy strikes in economically burdened nations like Haiti, people are forced to flee for their lives, seek shelter in alternate locations, and find unique ways to support themselves financially. The geographical illustrations show the redistribution of Digicel Haiti subscribers from the centre of Les Cayes and Camp Perrin to other locations

across the Nation. As the article conveys, these results could be caused partially by residents leaving, but also partly by visitors not coming into the city center as much as before. In a fragile nation like Haiti, a sharp decrease in citizen influx, tourism, and economic flow can cause serious long-term damage.

Inherently, Haiti is a nation plagued by different levels of poverty, disease, and instability. Strong hurricanes, storms, and earthquakes can severely hinder human development and one major event can result in an automatic natural reset. Yet similarly, another important idea was presented towards the end of the report: An increase in national disasters (like earthquakes) results in an increase in time for travel routes. As seen by the final graph, there was an "increase on the day of the earthquake of the median length of the routes traveled in the departments of the south, Grand'Anse and Nippes and a strong decrease from Sunday 15 to Tuesday 17 included" (Population 5).

In relation to Amartya Sen's definition of development, Amartya explains that human development requires the removal of a variety of civil, economical, and social unfreedoms - poverty, tyranny and economic deprivation to name a few. What people can achieve is influenced strongly by economic opportunities, and when these opportunities are taken away by natural disasters, as the author implies, freedom is a challenge to achieve.

Likewise, in relation to the article, sustainable development goals can include a more immediate and effective response to natural disasters, better education to indirectly improve local

infrastructure, and additional sources of transportation. The authors in this report are

focusing on the development process of human mobility and poverty, and trying to

answer the scientific question: *how do nation-wide disasters impact movement and*

mobility in a poverty-ridden nation?

Power, Daniel, et al. Digital Impact Alliance (DIAL), 2019, pp. 4–12, *FlowKit: Unlocking the*

Power of Mobile Data for Humanitarian and Development Purposes. **Accessed 22**

Sep. 2021. On October 4th 2016, Matthew, a category four hurricane, made landfall over

southwest Haiti, resulting in catastrophic damage to the Grande Anse and Sud regions.

The storm cost almost two billion dollars in damage, took the lives of 500 people in

Haiti, and displaced many thousands of people. One of the biggest ideas relating to

harmful events that came up in the case study was the idea of the cholera epidemic - an

already devastating swing of disease that had taken the lives of many Haitian people.

With Hurricane Matthew destroying water supply infrastructure, sanitation systems, and

established cholera treatment centers, the already fragile healthcare system in Haiti

seemed to be at the brink of collapse.

This brings the reader to the second main idea presented in the report: The presence of cholera

increased the need to identify human displacement, with a "particular emphasis on

understanding where people had come from, as this information was used to inform

relief management efforts on containing the disease among a highly vulnerable

population" (Daniel 7). With a high displacement among citizens, inadequate access to

hospitals, a lack of essential technology, and the ability for most to only travel by foot, how would this information be reported? Flowminder. Flowminder was able to help by corralling Digicel's mobile data, information that would have been difficult and costly to obtain through other means, particularly post-disaster.

In relation to geospatial data, Flowminder was able to use FlowKit, a suite of software tools that help humanitarian and development organizations access and analyze mobile data from a geographical standpoint. In terms of data science methods, the report included graphs, clustering of individuals, and Bayesian statistics.

Likewise through this article, sustainable development goals should be focused on initiating efforts that can improve healthcare in Haiti, impactful sanitation systems, storm-response education, and mandating evacuation. Local government did not mandate or even impose any evacuation route system, something that would have decreased chaos drastically. The article also put an emphasis on a specific dimension of human development: education and health, focusing on the scientific question *how did the people of Haiti respond in the aftermath of Matthew in relation to movement and health?* and *how can data scientists cluster individuals into specific movement groups based on cell tower data?*

Lastly, relating to Amartya Sen's definition of development, without the removal of unfreedom like neglect of public facilities and healthcare, true freedom can't be achieved. What people can positively achieve, as Yen states, is influenced by the economic

opportunities, political liberties, social powers, and most importantly relating to this report, good health, education, and cultivation of initiatives.

Calais E, Boisson D, Symithe S, Prépetit C, Pierre B, Ulyse S, Hurbon L, Gilles A, Théodat J-M, Monfret T, Deschamps A, Courboulex F, Chèze J, Peix F, Bertrand E, Ampuero J-P, Mercier de Lépinay B, Balestra J, Berenguer J-L, Bossu R, Fallou L and Clouard V (2020) A Socio-Seismology Experiment in Haiti. *Front. Earth Sci.* 8:542654. doi: 10.3389/feart.2020.542654 Accessed 27 Sep. 2021. Over the past fifty years, earthquakes have cost about 800 billion U.S. Dollars, mostly in developed countries, and 1.3 million human lives, mostly in developing countries. Haiti, a small island nation notoriously known for its earthquake disasters, is continuing to look for innovative ways to track these disasters and the impact on local communities. A network of inexpensive seismometers, installed in people's living rooms, gardens and workplaces across Haiti, has helped scientists in unraveling the inner workings of the magnitude-7.2 earthquake in August of 2021. This scientific study provides us with sample data results.

In a country whose official seismic-monitoring stations are sometimes offline because of limited resources, this community-seismology project has provided data scientists much-needed data. The seismometers are able to feed data into a system that displays the locations and magnitudes of Haitian earthquakes on a web-based portal in real time, a sharp contrast from where Haiti was just eleven years prior with the major earthquake of 2010.

In relation to the inherent and complex nature of human development in Haiti, many people do

not have access to proper technology in order to analyze complex situations like

earthquakes and other natural disasters. Not only that, but as implied in previous articles,

education is lacking severely in Haiti. A constant cycle where adults aren't educated and

therefore struggle to educate Haitian children, one may ask *how is this cycle finally*

broken?

The results have shown at least 600 aftershocks from the 14 August quake so far, compared with

roughly 10 in the same time period after the 2010 quake. Calais, a leader of the study,

stated "We now have very strong information about not only where the [14 August]

quake occurred, but also how wide the rupture was, in which direction the fault was

dipping," he adds. 'That's essential' to understanding why the quake occurred and what

to expect in the future. In a world constantly changing from human impact and

development, having this technology in undeveloped countries is going to be key.

The geospatial datasets used in this study pertain to two different categories: vectors/attributes

and social media data. In relation to vector/attributes, points, lines, dots, and other

polygons were used to show the location of aftershock earthquakes, their magnitude, and

overall direction. Social media data was also brought up for the limited amount of

people in Haiti who have it: "However, in the age of social media and participatory

science, complementary ways to produce reliable and actionable earthquake information

through the involvement of citizens and/or communities are emerging that warrant

further investigation" (Calais 4). Calais was also able to provide certain big data statistics from local social media posts. Geospatial data methods also include local surveying, maps, and cartography.

Amartya Sen argues in his *Forms of Unfreedom* section in chapter one that unfreedom can come in all shapes and sizes, and each unfreedom is somehow interconnected. But more importantly, he also implies throughout the article that opportunities aren't given equally around the world. In this study, it becomes evident that Haiti's access to current technology, data methods, and other resources is lacking significantly when compared to nations that are more advanced like the United States. Indirectly, this lack of access to current methods (like seismograph sampling) has potentially resulted in additional deaths in Haiti. Sustainable development goals should include developing more seismograph centers around Haiti for future earthquakes, but most importantly, enhanced technology on all fronts.

Zagattia, Guilherme Augusto, and Miguel Gonzaleza. "A Trip to Work: Estimation of Origin and Destination of Commuting Patterns in the Main Metropolitan Regions of Haiti Using CDR." ***Development Engineering*****, Edited by Ashok Gadgil, vol. 3, no. 2352-7285, 2018, pp. 133–165., https://www.sciencedirect.com/science/article/pii/S2352728517300866?via%3Dihub. Accessed 1 Oct. 2021.** This peer reviewed article begins by addressing one of the main problems at hand in Haiti: Rapid urbanisation with

the absence of economic growth has led to increasing socioeconomic challenges. After

the major earthquakes in 2010 and 2021, population displacement occurred rapidly across

the country. With almost 6 million Haitians living in urban areas, as the article explained,

cities now host over 0.5 million more inhabitants than rural areas. The rapid, unplanned

urbanisation in Haiti has generated a series of urban mobility challenges which have

contributed to job market fragmentation and a decrease in quality of life.

Data on population and job distributions, and on home-work commuting patterns in major urban

centres of Haiti is scarce, with the last census not being taken until 2003. The article

shows how scientists have taken advantage of nationwide de-identified Call Detail

Records (CDR) from the main mobile operator to investigate night and daytime

populations densities and commuting patterns.

Geospatial datasets used in this study include cell phone data, calls routed by satellite, and other

census data based on GPS location coordinates. In relation to methods, this study uses a

variety ranging from clustering algorithms, to k-means, trend lines standard deviation

(descriptive statistics), and Gaussian mixture clustering methods. The scientists are trying

to answer a few different questions regarding how the population distribution trends have

changed in Haiti over the years and how it has become more urbanized.

Haiti has faced challenges in undertaking traditional estimations of commuting patterns from

survey data. Since the last national census was taken in 2003, Haiti has suffered a series

of tragedies including an earthquake in 2010 and 2021, a cholera outbreak in 2011 and

Hurricane Matthew in 2016. Such events had a significant impact on the population

distribution and urbanisation trends, and hence lead to questions regarding the population

patterns. This relates directly to Amartya Sen's article in terms of his argument of the

major unfreedoms: one unfreedom leads to another, which indirectly leads to another, and

this overall corrupts a nation. Plagued by many different events with a weak government

that has failed to help its citizens, the people of Haiti have moved towards cities where

there are more opportunities to improve standard of living. This also directly relates to

West's argument about cities: the positives of cities (opportunities and growth) outweigh

the negatives (crime, disease, density) for people. Cities foster new beginnings and better

job opportunities.

Sustainable development goals for Haiti should include providing the most job opportunities

possible for citizens to stimulate the economy. After the Great Depression in the USA,

Roosevelt found unique ways to create jobs and stimulate the economy by creating

different work programs. For example, people worked on creating federal parks, a major

highway system, and new infrastructure. This will be crucial for Haiti over the upcoming

years.