Samuel Cooper

Human Development - Data Science

5 December 2021

Disaster Response and Economic Instability in Haiti (1927 words)

"Development consists of the removal of various types of unfreedoms that leave people with little choice and little opportunity of exercising their reasoned agency" (1) Amartya Sen explains in his *Development as Freedom*. What people can achieve is influenced strongly by the economic opportunities available within a nation, and when these opportunities are taken away by external entities, Sen implies that freedom is a challenge to achieve. In the economically and socially burdened nation of Haiti, people are dealing with just that - an everyday fight to feed their families and to remove unfreedoms in the form of poverty, economic inequality, and lack of care for facilities to name a few.

United Nations Secretary-General Kofi Annan argued in 2005 that "A world of interdependence cannot be safe or just unless people everywhere are freed from want and fear and are able to live in dignity… the rights of the poor are as fundamental as those of the rich, and a broad understanding of them is as important to the security of the developed world as it is to that of the developing world" (2). Since the year 2010, citizens across Haiti have indeed been trapped in a world of fear. On January 12th 2010, a magnitude 7.0 earthquake struck the Republic of Haiti, with an epicenter located approximately 25 km south and west of the capital city of Port-au-Prince (3). Not only did it take the lives of 200,000 and cost almost $11 billion in reparations (close to 100% of the nation's gross domestic product), but the natural disaster resulted in the displacement and economic devastation of thousands (4).

As a result of such negative externalities in the nation of Haiti, different trends relating displacement, disaster response, urbanization and economic instability have been analyzed, proving a variety of statistical results to the following research question: *When disaster strikes in a burdened nation, how do those impacted respond and how effectively are response efforts implemented?* In other words, where do people go? What are these people trying to do? What are their intentions, and how are they aided by local organizations and response efforts? Through aggregated clustering of mobile data and the use of satellite imagery and maps, two different yet impactful data science methods, study directors and data scientists have been able to provide meaningful answers to these complex questions. With the clustering technique, scientists have been able to sample different cell tower locations and track citizens through the use of their mobile device. With satellite imagery and maps in aid of statistical tools, density and depth with respect to the number of people in a given area have also been used.

In terms of a research gap reflecting a limitation and need for improvement within this mobile data clustering method, the study explains that Digicel Haiti, with 2.2 million subscribers and a network that covers 90% of the inhabited areas, was the experimental group used (5). There are two main reasons that this strategy could have resulted in potentially skewed data and certain misleading conclusions. Firstly, Digicel Haiti only covers 90% of inhabited areas in the nation, leaving the other 10% completely unrepresented within this study. Secondly, and most importantly, the teqnicnique of using mobile data does not even take into consideration those

without electronic devices. Haiti is a nation plagued by economic disparity and instability, and owning a phone for many people is extremely costly and not very feasible. In essence, this given technique from the study has failed to not only represent the 10% who do not use Digicel Haiti, but it also fails to consider a large proportion of people who do not have phones, potentially resulting in misrepresented results.

In response to this gap in the literature, many of the studies I came across in my research talked about the impact of survey data. So, while putting the idea of money aside, instead of using phone data or satellite imagery, a simple online survey could be used after another natural disaster occurs. At the city hall of each municipality or in a designated area, computer systems could be set up and a backup paper survey could be available if the internet isn't working. This takes away the need for an electronic device or any device at all. Likewise, in order to actually get a proper turnout, some type of incentive could be put into place (most likely money) in order to incentivize Haitian citizens to come fill out the survey.

The following figure contains an image with what the general format of the survey could look like, with a few more simple questions in order to make statistical conclusions and comparisons. But most importantly, we want to be able to collect aggregate data based on geographical location within each department (Haiti has 10 departments, which are simply states). Once the given department is chosen by the Haitian citizen, another dropdown menu could pop up with a question asking *within this specific department, what municipality are you currently in?*

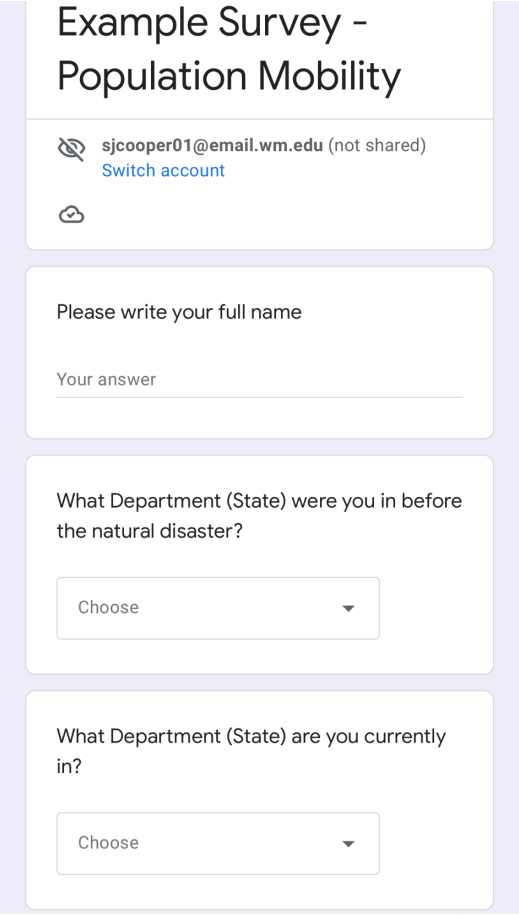

Fig 1

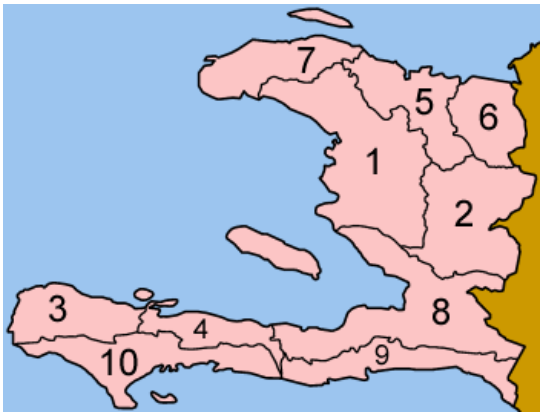

Fig 2

In terms of potential benefit from successful implementation of this research plan, volunteer groups, dedicated teams, the government, and other groups will be able to more accurately track citizens across the nation in order to direct relief efforts. While phone data was useful in previous studies, again, it left out large portions of people and relief groups were not as accurate, efficient, and timely in their response. By collecting this data, using statistics, and attempting to discredit potential errors from the system, physical images and maps like the figure shown below will be able to be generated.

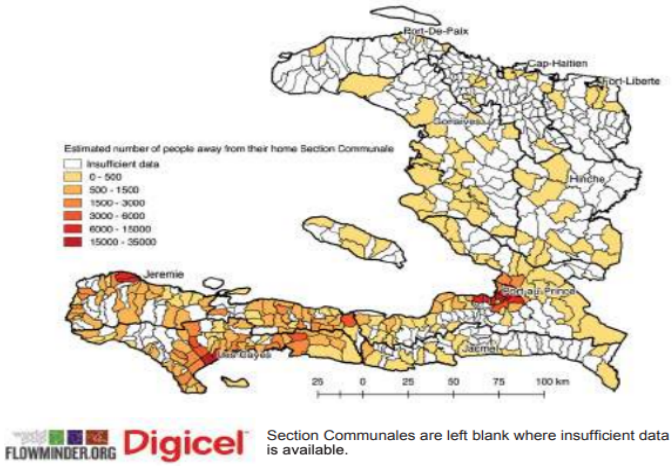

Fig 3

With this study and research plan, it will be contingent on the fact that a natural disaster actually occurs, which brings up the idea of morality and ethics. Clearly, as ethical human beings, we don't want a damaging natural disaster to occur in Haiti, but for the purposes of this study, this is how we will collect the data.

The steps for implementing this research plan are clear, yet potential barriers could provide problems. Firstly, a proper survey needs to be generated. What questions will be asked? Who will create the survey? Who will be the test subjects for the survey? What server will we use for the survey? These are all valid questions that need to be considered, among other things.

Secondly, a plan needs to be put into place in relation to the computer systems and incentive for the citizens to come. How will citizens get to city hall/the designated area in a given municipality? Who will fund the computers and incentive for the Haitian citizens? How will the backup paper survey be implemented?

Lastly, the data scientists must consider how they will interpret, analyze, and present the data to the world. What formulas will be used? What methods will be used to examine the data? Will maps, images, or other visuals be used? These are all important questions that must be asked.

As a hypothesis, I predict that when another natural disaster occurs in the nation of Haiti in similar scale to the 2010 earthquake, we will see a larger rise in population change from very rural, poor areas that did not see as much of a change in the phone usage study. A lot of people in the mountainous regions of Haiti, outside of the major cities and capital, do not have access to phones and even electronic devices (6). In contrast from before, these people will now be able to be tracked (that is, if they participate) and data will be more inclusive to all groups. The major cities, like Canaan and Port-au-Prince, will see larger increases in density, as I predict.

In terms of major obstacles I plan to see, there are two large ones I can visualize. Firstly, I am concerned about the idea that if internet service is not available, the backup paper survey will be used. The group in charge of this survey will have to guarantee that it is not taken advantage of and that corruption from the government or outside parties does not make it's way in. Likwise, time is going to be key here. We must make sure that the information in transported to a central hub quickly and efficiently, as people's lives are on the line and an additional minute of time could mean the death of hudreds. When the data arrives to a central hub, volunteers must be ready to load the information into a central database as efficiently as they can.

Another obstacle I plan on seeing is Haitian citizens taking advantage of the incentive system. When money is at stake, people can often resort to ravenous, inconsiderate ways that generate problems. The way this will be solved is with photo imagery, proof of identification, and a fingerprint scanner. People will be required to take a photo, give their name and potential address, and also scan their fingers so people are not coming back for more and more money. This will defeat the purpose of the entire system, and most importantly, skew the data drastically. To put things into perspective, if every Haitian citizen took the survey twice, all the data would essentially be doubled.

United States funders should consider funding this plan for a variety of different reasons. Firstly, the plan has the potential to save countless lives and prevent the potential collapse of an entire nation. Haiti is and has been on a dark track for almost twenty years now. Who will take on Haiti's burdens if the government officially collapses? Will the UN step? This study has the potential to save lives, improve census data to direct efforts, and increase citizen's confidence and pride within their nation. Secondly, we have the idea of American citizens. According to the 2019 U.S. Census, there were 1,084,055 Haitian Americans living in the USA, with 78% of this population still identified as having family in Haiti (7). With such a large number of Haitian citizens and people identifying as having family, supporting these people is most important.

One major objection I expect to encounter is that people claim the phone clustering tactic was simply not any different than the survey I decided to conduct. I will counter this simply by asking certain questions in my survey to show that all groups were equally represented. Once the results are put into visual form and the numbers are aggregated, I will show people that we actually collected more data than in the phone clustering study, and that people without a cellular device were actually represented.

For the budget, I propose the following: we will start by addressing the computer costs. Haiti has a total of 10 departments, with 571 communal sections. I propose that we designate 5 computers, on average, per communal section, making a total of 2,855 computers We will by Lenovo Chromebooks, with each priced at $120. This brings the total cost to $342,600 + $1000

for shipping = $343,600. In relation to the incentive, I believe that each citizen should receive $5 (this is really good, considering the weight of the US dollar). $1,000,000 should be kept on hand for Haitian citizens. We then have to factor in other technology (~$50,000), wages ($750,000 for everyone in the study, and those paid in Haiti). Lastly, we will factor in $100,000 for travel, food, other miscellaneous equipment, and anything else that is necessary. This brings the total cost to $2,243,600 for this major study.

Works Cited:

(1) 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/S23 52728517300866?via%3Dihub. Accessed 1 Oct. 2021.**

(2) Sen, Amartya, 1933-. Development as Freedom. New York : Anchor Books, 2000.

(3) **Annan, K. 2005.** ***"In Larger Freedom":*** **Decision Time at the UN. Foreign Affairs. Available at: http://www.unis.unvienna.org/pdf/freedom_annan.pdf. Accessed 6 October 2021**

(4) Eberhard, M. O., Baldridge, S., Marshall, J., Mooney, W., and Rix, G. J., 2010. The MW 7.0 Haiti earthquake of January 12, 2010: USGS=EERI Advance Reconnaissance Team Report, USGS Open File Report 2010–1048, U.S. Geological Survey, Reston, VA, 58 pp. Accessed 1 October 2021

(5) 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.**

(6) Person. "Cell Phones and Radios Help Save Lives after Haiti Earthquake." ***Reuters*****, Thomson Reuters, 25 Jan. 2010,https://www.reuters.com/article/us-haiti-telecoms/cell-**

phones-and-radios-help-save-lives-after-haiti-earthquake-idUSTRE60O07M20100125. Accessed 10 October 2021

(7) West, Geoffrey B. *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life in Organisms, Cities, Economies, and Companies*. Penguin Press, 2018.