OPEN DATA'S IMPACT

BATTLING EBOLA IN SIERRA LEONE

Data Sharing to Improve Crisis Response

OPEN DATA

By Stefaan Verhulst and Andrew Young[*]
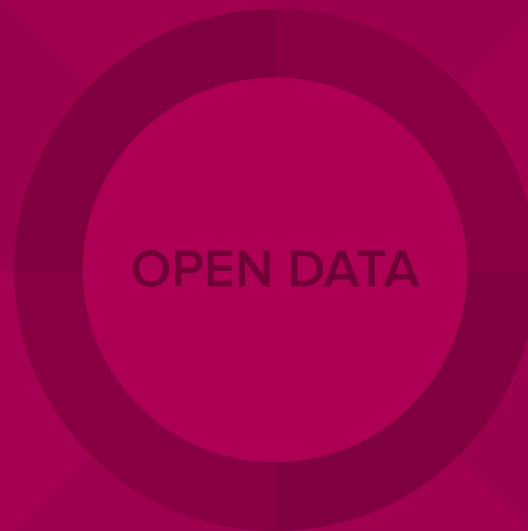
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Summary

In 2014, the largest Ebola outbreak in history occurred in West Africa. Information on Ebola cases and response efforts was dispersed across a diversity of data collectors, and there was little ability to get relevant data into the hands of those who could leverage it. A number of data-driven initiatives sought to improve the quality of information available to humanitarians working to address the crisis. This case study examines three initiatives in particular — Sierra Leone's National Ebola Response Centre (NERC), the United Nation's Humanitarian Data Exchange (HDX) and the Ebola GeoNode — and shows both the potential and challenges of open data projects in combating Ebola specifically, and more generally in addressing humanitarian crises.

Dimension of Impact

- ✓ Solving Public Problems
- ✓ Data-Driven Engagement

Key Takeaways

- Data and information have important roles to play in the battle not just against Ebola, but more generally against a variety of natural and man-made crises.

- However, in order to maximize that potential, it is essential to foster the supply side of open data initiatives — i.e., to ensure the availability of sufficient, high-quality information. This can be especially challenging when there is no clear policy backing to push actors into compliance and to set clear standards for data quality and format.

- Particularly during a crisis, the early stages of open data efforts can be chaotic, and at times redundant.

Improving coordination between multiple actors working toward similar ends – though difficult during a time of crisis – could help reduce redundancy and lead to efforts that are greater than the sum of their parts.

I. CONTEXT AND BACKGROUND

Open Data in Sierra Leone

In 2014, Sierra Leone was ranked 78th in the Open Data Barometer, a ranking which puts it near the bottom. It was nonetheless highlighted as a "country to watch," due to the country's Right to Access Information Law, passed in 2013, which requires proactive publication of a diversity of publicly held data and information.[1] The government has in recent years also made some efforts to make data more accessible to the public in digital and non-digital formats.[2] Also in 2013, Sierra Leone joined the Open Government Partnership (OGP), with open data projects representing a significant portion of its first OGP Action Plan commitments.[3]

One of the country's more important open data efforts is Open Data for Sierra Leone,[4] an initiative of the African Development Bank Group's Open Data for Africa project. The site contains a number of data sets and infographics focused on economics, demographics, agriculture, energy, health care, education, food security and international trade. Understandably, as of late 2015, the focus of the site appeared to be largely on Ebola cases and fatalities.[5]

The 2014 Ebola Outbreak

Ebola virus disease (EVD) was first discovered during two simultaneous outbreaks in 1976, one in Sudan and the other in the Democratic Republic of Congo. The disease takes its name from the Ebola River, where the Congolese outbreak first occurred,[6] and its symptoms include fever, severe headache, muscle pain, weakness, fatigue, diarrhea, vomiting, abdominal pain and uncontrollable hemorrhaging.[7]

In 2014, the first ever Ebola outbreak to occur in West Africa was also the largest outbreak of the disease in history, and, according to the US Centers for Disease Control and Prevention

1   Abdulai, Saffa. "Connecting Open Data and the Right to Information in Sierra Leone." Open Data Research Network. http://www.opendataresearch.org/content/2014/642/connecting-open-data-and-right-information-sierra-leone
2   http://www.opendatabarometer.org/report/analysis/rankings.html
3   http://www.opengovpartnership.org/sites/default/files/SIERRA%20LEONE_FINAL%20NATIONAL%20ACTION%20PLAN_6_15_2014_Final.pdf
4   http://sierraleone.opendataforafrica.org
5   http://sierraleone.opendataforafrica.org
6   "Ebola virus disease – Fact Sheet." World Health Organization. Updated January 2016. http://www.who.int/mediacentre/factsheets/fs103/en/
7   "Ebola (Ebola Virus Disease) – Signs and Symptoms." Centers for Disease Control and Prevention. http://www.cdc.gov/vhf/ebola/symptoms/

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(CDC), the "first Ebola epidemic the world has ever known."[8] From March 2014 to September 2015, 28,355 cases of Ebola were reported, over 66 times the number of cases reported in the previous (second-biggest) outbreak, which occurred in 2000-2001 in Uganda.[9]

The disease quickly spread across countries in West Africa – particularly Sierra Leone, Guinea and Liberia. The epidemic most likely spread so rapidly as a result of traditional burial practices and rituals that put family members of the deceased and those tasked with burying bodies at high risk for infection. Porous borders between the three countries also played an important role.[10] In September 2014, the UN Security Council declared Ebola a "threat to international peace and security";[11] experts predicted that the disease could kill 100,000 people and require $1 billion to successfully contain.[12]

On September 19, 2014, the United Nations Mission for Ebola Emergency Response (UNMEER) was established.[13] UNMEER was "mandated as a temporary measure to harness the capabilities of all the relevant UN actors under a singular operational crisis management system to reinforce unity of purpose among responders and to ensure a rapid and effective response to the Ebola crisis."[14] UNMEER headed up the UN's efforts to stop Ebola in West Africa until August 1, 2015, when the World Health Organization (WHO) took over a central coordinating role. Coordination between actors within Sierra Leone and across the international community proved essential to battling the Ebola crisis. Indeed, as the projects discussed below (and in several other case studies in this series) indicate, coordination, collaboration and information-sharing are central in the response to a variety of humanitarian and other crises.

8   "Ebola (Ebola Virus Disease) – Outbreaks." Centers for Disease Control and Prevention. http://www.cdc.gov/vhf/ebola/outbreaks/

9   "Ebola (Ebola Virus Disease) – Outbreaks Chronology: Ebola Virus Disease." Centers for Disease Control and Prevention. http://www.cdc.gov/vhf/ebola/outbreaks/history/chronology.html

10   Garrett, Laurie. "Ebola's Lessons: How the WHO Mishandled the Crisis." Foreign Affairs. September/October 2015. https://www.foreignaffairs.com/articles/west-africa/2015-08-18/ebolas-lessons

11   United Nations Security Council Resolution 2177 (2014). http://www.ifrc.org/docs/IDRL/UN%20SC%20Res.pdf

12   Spooner, Samantha. "Ebola could kill 100,000 and needs $1 billion to defeat, but Nigeria shows the world how it's done." Mail & Guardian Africa. September 21, 2014. http://mgafrica.com/article/2014-09-19-as-the-war-against-ebola-rages-nigeria-shows-the-world-how-its-done

13   Garrett, Laurie. "Ebola's Lessons: How the WHO Mishandled the Crisis." Foreign Affairs. September/October 2015. https://www.foreignaffairs.com/articles/west-africa/2015-08-18/ebolas-lessons

14   "UNMEER-WHO Transition Message." World Health Organization Regional Office for Africa. http://www.afro.who.int/en/sierra-leone/press-materials/item/7897-unmeer-who-transition-message.html

II. PROJECT DESCRIPTION AND INCEPTION

Using Data in Combating Ebola

Early on, it became apparent that information would be key in the battle against Ebola. Efforts to combat the epidemic were, for example, hampered by limited information sharing between national governments, aid organizations and front-line actors like the rural health clinics that often bore the brunt of the crisis. Even the most basic information – for example, the number of cases or dead – was hard to come by, making it difficult to assess the severity of the epidemic and target interventions. For all these reasons, the UNMEER chief, Anthony Banbury, promised in November 2014 that "We're going to be really data- and information-driven and that will strengthen our response."[15]

Recognizing the importance of information – governments, aid agencies and international organizations soon began designing and implementing a number of data tools. This case study focuses on three tools and initiatives that played a particularly important role in mitigating the public health crisis: the National Ebola Response Centre (NERC), the Humanitarian Data Exchange (HDX) and Ebola GeoNode.

National Ebola Response Centre (NERC)

In October 2014, Sierra Leone created the NERC, which led all facets of the on-the-ground Ebola response efforts in the country and coordinated the activities of District Ebola Response Centres (DERCs).[16] NERC brought together the Presidency of the Republic of Sierra Leone with the ministries of Health and Sanitation; Local Government and Rural Development; Social Welfare, Gender and Children's Affairs; Foreign Affairs; Finance and Economic Development; Defence; Internal Affairs; and Information and Communication. In addition, the NERC coordinated with external agencies and groups like the CDC, Red Cross, World Bank, UK Department for International Development (DFID), African Development Bank and the U.S. Embassy.

NERC was one of many efforts by international organizations and government actors to help domestic efforts to mitigate the effects of the disease and stop its spread. The African Governance Initiative (AGI), based in the United Kingdom, for instance, helped to set up a Situation Room within NERC, which focused on putting the most important information into the hands of the decision-makers in the best position to act on it. In many ways, the Situation Room – and NERC more generally – were primarily efforts to create the infrastructure for collecting and disseminating important information related to the crisis. This infrastructure was sorely needed because, as OB Sisay, the director of the Situation Room, put it: "The core crux of the problem is not Ebola. It's system failure."[17]

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15   Westcott, Lucy. "Q&A with Anthony Banbury: UN's Ebola Mission Can Still Do More." Newsweek. November 24, 2014. http://www.newsweek.com/qa-anthony-banbury-uns-ebola-mission-can-still-do-more-286724

16   Maxmen, Amy. "How Ebola Found Fertile Ground in Sierra Leone's Chaotic Capital." National Geographic. January 27, 2015. http://news.nationalgeographic.com/news/2015/01/150127-ebola-virus-outbreak-epidemic-sierra-leone-freetown-photos-pictures/

17   Maxmen, Amy. "How Ebola Found Fertile Ground in Sierra Leone's Chaotic Capital." National Geographic. January 27, 2015. http://news.nationalgeographic.com/news/2015/01/150127-ebola-virus-outbreak-epidemic-sierra-leone-freetown-photos-pictures/

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Rupert Simons, CEO of Publish What You Fund and formerly an adviser to AGI, helped to set up the Situation Room and led the team as it conducted daily data collection efforts of conditions on the ground. A key piece of these efforts involved the design, implementation and maintenance of a reporting system for the 14 districts in Sierra Leone. Simons describes the reporting system as one where districts were asked to "call or email us once a day with information on the response. We didn't ask them how many Ebola patients they had; the Ministry of Health knows that already. But we did ask how many safe beds they had, how many calls they got every day to investigate a case, and how many people had died, because everyone who dies needs to be given a safe medical burial."[18]

Armed with such on-the-ground information, the Situation Room hosted twice-daily briefings for leadership at NERC.[19] These briefings, focused on identifying and operationalizing key action points based on the day's information, typically included officials from the government, UNMEER and other UN agencies, and governmental and nongovernmental aid agencies.[20]
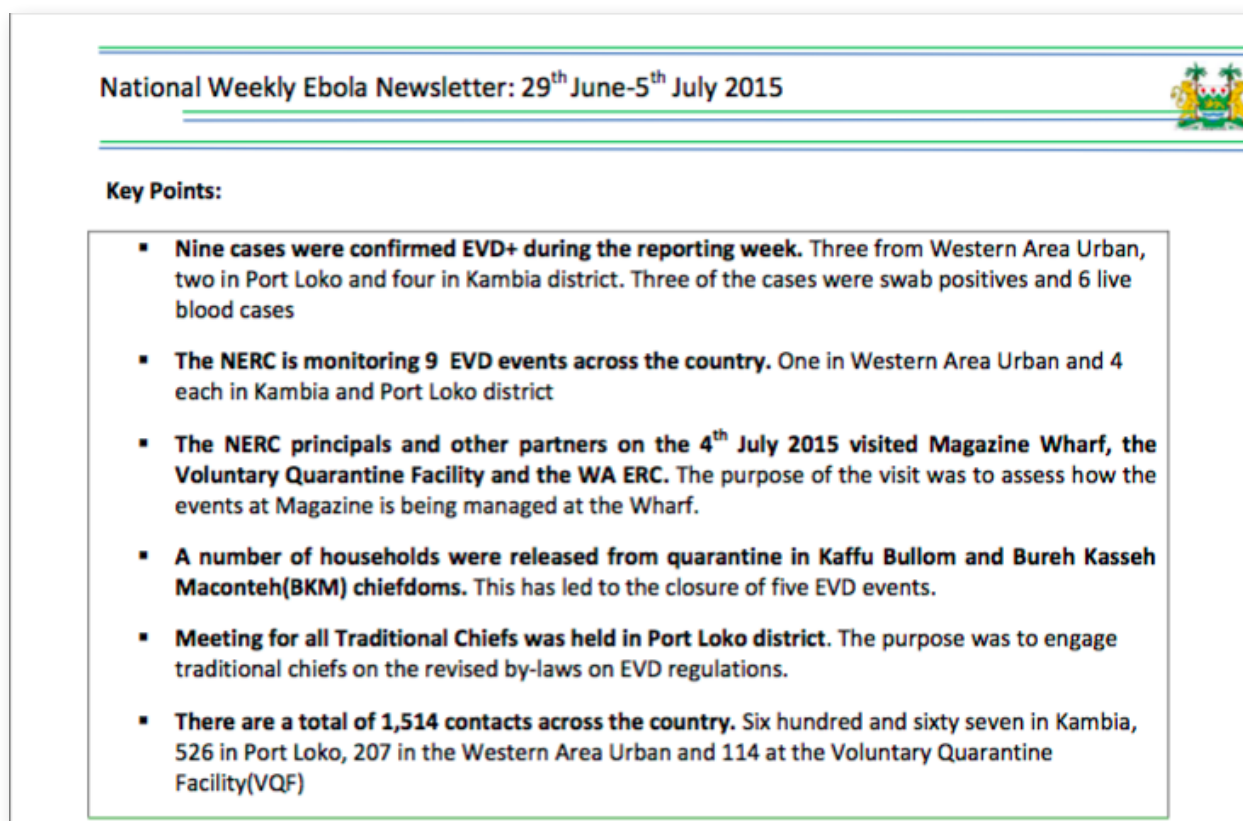

National Weekly Ebola Newsletter: 29th June-5th July 2015

Key Points:

- **Nine cases were confirmed EVD+ during the reporting week.** Three from Western Area Urban, two in Port Loko and four in Kambia district. Three of the cases were swab positives and 6 live blood cases

- **The NERC is monitoring 9 EVD events across the country.** One in Western Area Urban and 4 each in Kambia and Port Loko district

- **The NERC principals and other partners on the 4th July 2015 visited Magazine Wharf, the Voluntary Quarantine Facility and the WA ERC.** The purpose of the visit was to assess how the events at Magazine is being managed at the Wharf.

- **A number of households were released from quarantine in Kaffu Bullom and Bureh Kasseh Maconteh(BKM) chiefdoms.** This has led to the closure of five EVD events.

- **Meeting for all Traditional Chiefs was held in Port Loko district.** The purpose was to engage traditional chiefs on the revised by-laws on EVD regulations.

- **There are a total of 1,514 contacts across the country.** Six hundred and sixty seven in Kambia, 526 in Port Loko, 207 in the Western Area Urban and 114 at the Voluntary Quarantine Facility(VQF)

Figure 1: Portion of National Ebola Response Centre Weekly Newsletter

18   Simons, Rupert. "Inside the National Ebola Response Centre." Africa Governance Initiative. October 17, 2014. http://www.africagovernance.org/article/inside-national-ebola-response-centre

19   GovLab interview with Rupert Simons, Former Advisor to the African Governance Initiative; CEO Publish What You Fund, August 6, 2015.

20   Example brief: http://nerc.sl/sites/default/files/docs/20151126_Nerc_Eve_Brief%20Count%20Down.pptx%201.pdf

NERC also shared a daily evening briefing with the public (usually by radio), as well as a weekly newsletter and press conference.[21] The public briefings included a wide variety of data on the current Ebola situation, including facts and figures on the status of the disease (often broken up by region), the location and accessibility of treatment centers, and other information on steps to address the crisis.[22]

Humanitarian Data Exchange (HDX)

On July 15, 2014, at the Open Knowledge Festival in Berlin, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) announced the development of the Humanitarian Data Exchange (HDX). HDX was intended as "a new data sharing platform that encompasses the best standards in data collection, offering access to useful and accurate data."[23] Designed to cover a wide range of humanitarian crises around the world, the platform was originally focused on two pilot locations in Kenya and Colombia. But as the Ebola crisis worsened, HDX's potential in West Africa quickly became apparent and it became one of the most important data efforts in the fight against the epidemic.

HDX has been referred to as a "humanitarian data-centric Wikipedia."[24] It allows users to track and follow specific data sets, create curated organization data hubs, and share data across previously siloed organizations working to improve humanitarian efforts around the world. [25] According to Javier Teran, an OCHA statistician who works on HDX, the platform focused from the start on the "baseline indicators that humanitarians are always using, like population statistics and mortality rates – the types of data related to a crisis, before, during and after."[26] At its launch, HDX held around 1,600 files, covering a range of regions and humanitarian concerns – but none of those files were targeted to the use case that would take HDX from being a largely speculative platform to one being put to real practical application.[27]

By late 2014, Teran recalls, "we [the team behind HDX] were appointed by the UN to be the platform for Ebola data exchange."[28] At that point, the original 1,600 files on the platform were significantly increased in number, mostly with the addition of regional data – from Sierra Leone, Guinea and Liberia – drawn from WHO. WHO fed data into the platform on the number of Ebola

21   GovLab interview with Rupert Simons, Former Advisor to the African Governance Initiative; CEO Publish What You Fund, August 6, 2015.
22   Example newsletter: http://199.230.52.230/sites/default/files/docs/National%20%20Ebola%20Response%20%20Centre%20--%20Weekly%20%20%20Newsletter%20%2029th%20June%20-5th%20July%202015%20%282%29.pdf
23   "Humanitarian Data: OCHA launches ground-breaking data exchange platform." United Nations Office for the Coordination of Humanitarian Affairs. July 15, 2014. http://www.unocha.org/top-stories/all-stories/humanitarian-data-ocha-launches-ground-breaking-data-exchange-platform
24   Griliopoulos, Dan. "Data exchange helps humanitarians act fast and effectively." The Guardian. December 29, 2014. http://www.theguardian.com/global-development/2014/dec/29/humanitarian-data-exchange-ebola-refugees
25   Griliopoulos, Dan. "Data exchange helps humanitarians act fast and effectively." The Guardian. December 29, 2014. http://www.theguardian.com/global-development/2014/dec/29/humanitarian-data-exchange-ebola-refugees
26   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.
27   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.
28   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

cases and fatalities, the locations of cases, the amount of money being spent on the crisis, as well as information on Ebola Treatment Centres (ETCs – e.g., how many were open at the time, how many were eventually planned to be opened, and their locations).[29] On-the-ground WHO representatives were tasked with collecting, validating and curating the information.[30]

As of January 2016, HDX held 178 data sets on the Sierra Leone location page, including information on the number of health-care workers infected; status and location of ETCs; status and location of safe and dignified burial teams; location of education establishments; status and location of Ebola Community Care Centers, and much more.[31] The expected opening date for new ETCs was one of the most important pieces of information in HDX.[32] This information was immediately made open in computable formats to analysts and developers working on Ebola response.

In order to collect all this information, the HDX team combined WHO situation report data with information pulled from existing data sources, like OpenStreetMap's geospatial data and OCHA's common operational data sets.[33]

A central task confronting the HDX team from the start was the need to "make connections with the different players in the field."[34] Teran notes that, "it was a very difficult assignment, especially at the beginning of the crisis," due to a lack of sophistication in existing information systems. For example, it took some time for WHO representatives "to consolidate the information, to standardize it, to make it comparable" with information from other sources and other countries. This challenge, like Ebola itself, was not limited to Sierra Leone. "We were dealing with not only one country, but with three countries," says Teran.[35] This need to work across borders added a significant degree of complexity to the HDX effort, and indeed to the other data projects discussed in this case study.

As the HDX platform matured, visualizations, many created with platforms like Tableau and CartoDB, were also added. The top of the Ebola Crisis page featured a link to each of the most important data sets on the platform: Cumulative Cases of Ebola, Cumulative Deaths from Ebola, Response Plan Coverage, People Receiving Food Assistance, and Open Ebola Treatment Centers. Each of these could be viewed as raw data or as user-friendly visualizations. According to Teran, the statisticians leveraging HDX data were "trying to convert all these spreadsheets, CSVs, and maps into information" that was more easy to digest and

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29   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

30   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

31   https://data.hdx.rwlabs.org/group/sle

32   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

33   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

34   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

35   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

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understand.[36] While the raw data was essential for policymakers and others fighting the disease, the visualizations played a particularly important role in disseminating information through intermediaries like the media.
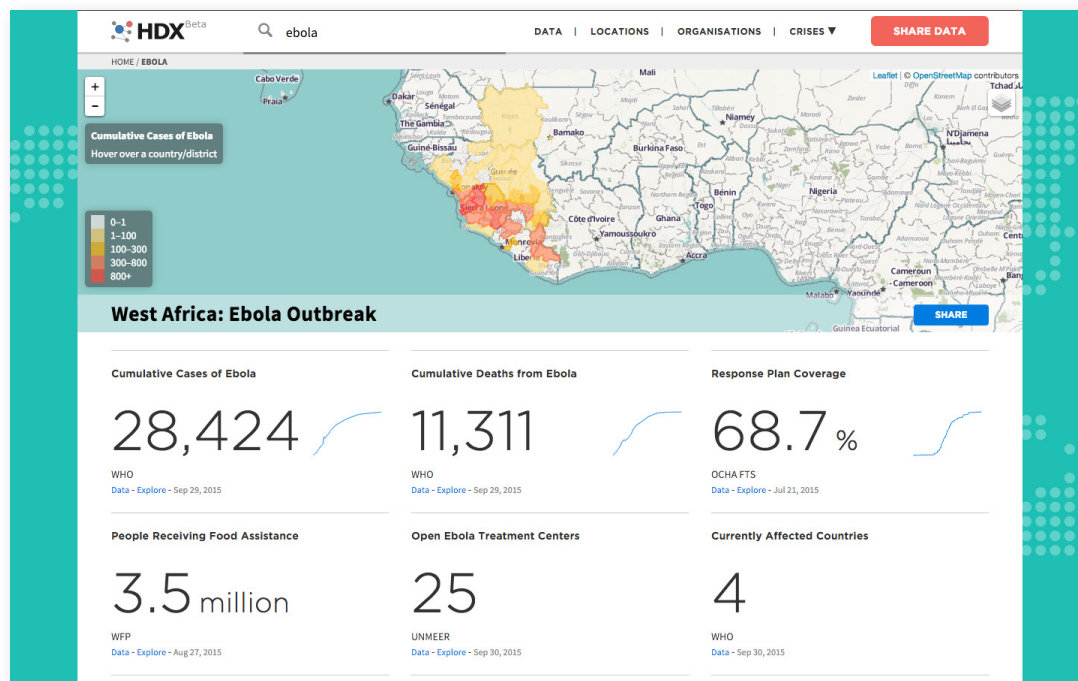

Figure 2: Humanitarian Data Exchange Ebola Crisis Page

The Ebola GeoNode

The result of a collaboration with the Red Cross, World Bank, Global Facility for Disaster Reduction and Recovery (GFDRR), UNMEER and the US Humanitarian Information Unit (HIU), Ebola GeoNode is an open source geospatial platform that lets users build maps and conduct geospatial analysis on Ebola's impacts in West Africa. According to Patrick Dufour, a former senior Web GIS developer at HIU, Ebola GeoNode is primarily "an open data platform" designed with the intent "to make as much [data] as you can, open."[37]

Currently, GeoNode consists of 61 data sets containing data on, among other things, administrative boundaries in affected countries, transportation and logistics information, and geo-tagged health crisis data. According to Dufour, logistics data – like the location of ETCs health facilities – occupy an especially important piece of the platform. While simple, such information helped to ensure that on-the-ground actors, like representatives of USAID and UNMEER, had a clear understanding of the location of important points – "sav[ing] a bunch of people time."[38]

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36   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.
37   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.
38   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.

The GeoNode is more than a simple collection of points on a map, however. Information on the platform exists in three categories: Layers, Maps and Documents. In the Layers and Maps categories, users have the option of manipulating the information directly on the GeoNode website or downloading it for any other use. For example, when selecting the Sierra Leone Community Care Centres (CCC) layer, the user can download the geospatial data on the CCC's locations to her hard drive in a variety of formats, *or* create a new map on GeoNode using the CCC data as one layer, with the option of adding additional layers – like the location of global supply routes.[39] Similarly, the eight user-generated maps on the platform – Food Insecurity (Estimates), Health Facilities, Mali Admin Boundaries, Sierra Leone Admin Boundaries, Guinea Admin Boundaries, Liberia Admin Boundaries, and two Ebola Care Facilities maps[40] – can be viewed, shared and printed as is, or duplicated and further built upon with additional geospatial data layers. The Documents category includes mapped trend analyses, such as "Evolution of confirmed Ebola cases over the period from 12 January to 22 February 2015."[41] These documents can be accessed directly, or the user can download the underlying metadata in a number of formats.
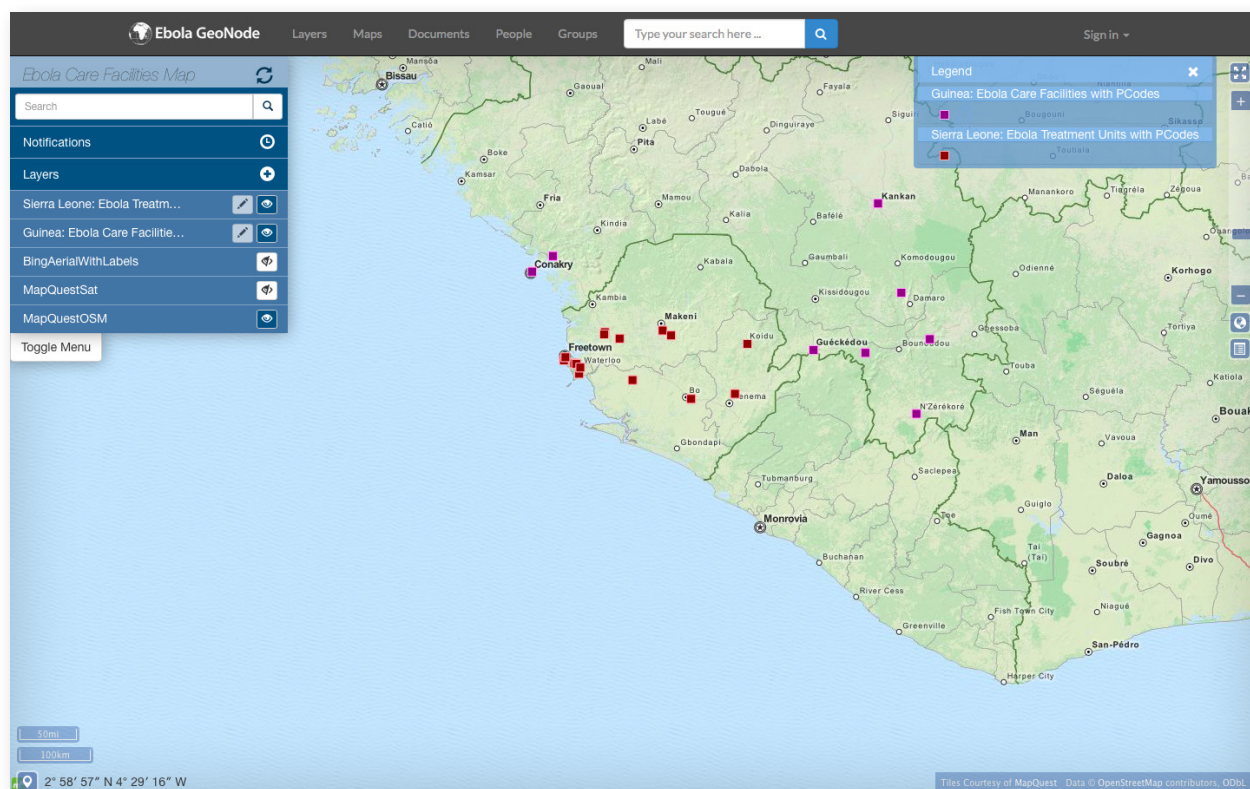

Figure 3: Ebola Care Facilities Map on Ebola GeoNode

The central purpose of the GeoNode platform was to alleviate information fragmentation that hampered the fight against Ebola. As the GFDRR website puts it: Data fragmentation meant

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39   http://ebolageonode.org/layers/geonode%3Asle_heal_pt_unmeer_ccc
40   http://ebolageonode.org/maps/#?limit=100&offset=0
41   http://ebolageonode.org/documents/541

that "field staff had to devote scarce time to finding and reassembling the data sets. In many cases, this task was far more difficult than it needed to be."[42] GeoNode played a particularly important role in enabling collaboration between employees working at international institutions and those on the ground in affected countries, particularly UNMEER representatives and employees of MapAction, a humanitarian mapping charity.[43] Vivien Deparday, a disaster risk management specialist at GFDRR, points out that much of the work for those maintaining the GeoNode platform outside of West Africa was "providing technical support on the platform" for those on the ground and "maintaining some authoritative data sets" that could be used and supplemented by the UNMEER and MapAction representatives.[44] Dufour agrees that the work of the people on the ground was critical for collecting and operationalizing the relevant data for the GeoNode – "otherwise, it's just a bunch of people at headquarters talking to each other."[45]

III. IMPACT

As many of the case studies in this series show, information plays an important role in a variety of natural and man-made humanitarian disasters. Simons, who was on the forefront of the Ebola crisis, argues that, amid an epidemic, "data is absolutely crucial." He adds that it is especially important in the early stages of an epidemic, when responders must decide "how to deploy the initially scarce resources."[46] In this section, we examine some of the most important ways in which the data-driven efforts examined above had an impact on the Ebola crisis in Sierra Leone in particular, and West Africa in general.

Providing Evidence to Decision-makers

Across the projects included in this case study, one particularly important form of impact stands out: Data plays a critical role in giving policymakers a better understanding of conditions on the ground, and thus an evidence basis for their decisions. For example, HDX data was accessed (and supplied) by the UN World Food Programme (WFP), which turned out to be one of the main users of the platform. According to Teran, the WFP used HDX to understand how Ebola was affecting farmers and to forestall any potential food shortages. When Ebola hits agricultural communities, says Teran, "nobody collects the rice from the fields from the paddy, and then there is no way [the farmer] can bring it to market, and then it's a domino effect."[47] WFP used

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42   https://www.gfdrr.org/ebola-geonode
43   http://www.mapaction.org
44   GovLab interview with Vivien Deparday, Disaster Risk Management Specialist, Open Data for Resilience Initiative Operational Deployment Lead, Global Facility for Disaster Risk and Reduction, World Bank, December 17, 2015.
45   GovLab interview with Vivien Deparday, Disaster Risk Management Specialist, Open Data for Resilience Initiative Operational Deployment Lead, Global Facility for Disaster Risk and Reduction, World Bank, December 17, 2015.
46   GovLab interview with Rupert Simons, Former Advisor to the African Governance Initiative; CEO Publish What You Fund, August 6, 2015.
47   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

data tracking and visualization tools on HDX to monitor these potential problems and to help the relevant authorities develop an appropriate response.

While NERC also provided information to decision-makers within international aid and governance organizations, as Simons notes, "the priority at the time was to make good data available to decision-makers within the government of Sierra Leone."[48] In a post describing his time at NERC, Simons argues that, although much of the media focus during the crisis was trained on international organizations, "99% of those fighting [Ebola] in the field are Sierra Leoneans. Their government needs to lead that fight. The Situation Room provides them with the information to do so."[49]

The Impact of Maps

For the Ebola GeoNode in particular, and efforts to increase access to geospatial data more generally, assessing impact involves what Patrick Dufour of HIU calls a "perennial hard question":[50] What is the impact of maps? The impacts are perhaps clearer in the case of Ebola response than in other uses. For instance, an article on OpenStreetMap (OSM), a free, crowdsourced mapping tool that provided information to NERC, HDX and GeoNode, notes that: "In the parts of West Africa affected by the Ebola epidemic, Google barely has the roads mapped out. More often than not, the names of villages are missing – and sometimes the village altogether."[51] Simons also recognizes the importance of the OSM data, noting that prior to its existence, "the [only] way to find out where to go was driving around and asking for directions."[52]

The geospatial information, often provided by OSM and available on the GeoNode and HDX, demonstrates how filling an information void – even with something as simple as road information – can play an important role in fighting an epidemic as complex as Ebola. And though difficult to quantify, Dufour is "comfortable knowing that [the GeoNode] was a success" as a result of "knowing that some guy, when he was making his daily situation report, he was using the Ebola GeoNode every day."[53]

Spurring Wider Use of Open Data in International Organizations

As mentioned, one of the unexpected benefits – "a big achievement" in the words of Teran – that came from HDX's efforts in West Africa was inspiring greater uptake of open data in

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48   GovLab interview with Rupert Simons, Former Advisor to the African Governance Initiative; CEO Publish What You Fund, August 6, 2015.

49   Simons, Rupert. "Inside the National Ebola Response Centre." Africa Governance Initiative. October 17, 2014. http://www.africagovernance.org/article/inside-national-ebola-response-centre

50   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.

51   Cassano, Jay. "Inside the Crowdsourced Map Project That Is Helping Contain the Ebola Epidemic." Fast Company. October 22, 2014. http://www.fastcolabs.com/3037350/elasticity/inside-the-crowdsourced-map-project-that-is-helping-contain-the-ebola-epidemic

52   GovLab interview with Rupert Simons, Former Advisor to the African Governance Initiative; CEO Publish What You Fund, August 6, 2015.

53   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.

other international organizations. For example, as the WFP began publishing its food-price data as part of an effort to combat Ebola, it became more aware of the benefits of data and, in particular, open data portals. The organization has now increased its commitment to open data, publishing a range of information about food prices from around the world.[54] As of January 2016, the WFP organization page on HDX houses 19 data sets, including those pertaining to global food prices and food security in 70 locations. This is just one example of a phenomenon we have seen repeatedly in this series of case studies: how a single, localized use of open data can spur a much wider recognition of data's value and potential.

Patrick Dufour from HIU sees a similar development of an open data "ecosystem" that he believes "is going to have an impact on long-term humanitarian information sharing."[55] He points in particular to the collaborative and data-sharing culture built as a result of the Ebola GeoNode and HDX working together. Vivien Deparday, from GeoNode, agrees, seeing a "complementary role" played by GeoNode and HDX in combating Ebola, and adding that "we will be trying to formalize a bit more of these roles in future scenarios."[56]

Internal Capacity Building and Identifying Best Practices

Finally, given that both GeoNode and HDX were launched by organizations playing a direct role in the Ebola response, the information provided through the platforms was also useful in improving their own response efforts, as well as establishing internal best practices. Dufour, for example, emphasizes that HIU used the GeoNode to create its own map products and target response efforts. "I think that phrase is to eat your dog food," he says, emphasizing the valuable contribution made by the GeoNode platform to HIU's efforts on the ground.[57] Taking the longer view, HDX applied the lessons learned during the Ebola response in its next major humanitarian initiative: the Nepal Earthquake of April 2015. Teran notes that when HDX began work for Nepal, the team knew to quickly build a partnership with the national government, and to immediately identify and liaise with the main organizational player on the ground – in this case the International Organization for Migration (IOM).[58]

Further, many of the databases and data products created during the Ebola epidemic are likely to have a certain "asset value" that will extend beyond this immediate crisis. This is particularly true of the maps and cartographic products generated during the crisis, which are useful for a variety of circumstances beyond combating Ebola.

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54   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.
55   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.
56   GovLab interview with Vivien Deparday, Disaster Risk Management Specialist, Open Data for Resilience Initiative Operational Deployment Lead, Global Facility for Disaster Risk and Reduction, World Bank, December 17, 2015.
57   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.
58   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

IV. CHALLENGES

While the initiatives included in this case study had common areas of impact, they also faced common challenges. We have identified **three** main challenges that posed barriers to greater impact and effectiveness. Although we discuss these challenges with specific reference to the fight against Ebola, they also surface in many of the other case studies in this series, and have broader applicability to open data initiatives around the world.

Data Management

Perhaps the main challenge faced by many of the initiatives under discussion pertained to data quality. Some of the problems stemmed from quite simple – yet ultimately consequential – errors. For example, on the Ebola GeoNode, it was sometimes difficult to track when data was out of date. Dufour says that it was difficult to determine if a date referenced when data was published, collected or edited.[59] Likewise, simple misspellings of a patient's name could cause problems on the HDX platform, leading – at least initially – to what Teran says was significant data duplication. For example, a patient's name could be spelled differently at each stage of treatment (potential, suspected, confirmed), leading to that same patient being counted multiple times.[60]

The way the data was handled at ETCs also posed challenges for HDX. Internal capacity at ETCs, and particularly the speed with which they could report data to HDX, was, understandably, not always as smooth as would be hoped. More generally, the sheer task of coordinating Ebola response efforts across three countries created tremendous challenges. Teran recalls that data would arrive at different times from different countries, or that on any given day one or more country's numbers would simply never arrive – "it was always fluctuating."[61] He adds that these and other data problems were particularly acute in the early stages of the epidemic, that the crisis was an ongoing learning process for all involved, and that many of the data challenges eased as time went on.[62]

Collaborating with Government

Responding to an in-process crisis created major challenges of coordination and governance. For example, while on the ground in Sierra Leone working with NERC, Rupert Simons found that, "people spent a lot of time in coordination meetings instead of doing anything."[63] Coordination with national governments could be particularly challenging, forcing humanitarian workers to master the intricacies of national and regional politics while in the midst of a crisis.

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59   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.

60   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

61   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

62   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.

63   GovLab interview with Rupert Simons, Former Advisor to the African Governance Initiative; CEO Publish What You Fund, August 6, 2015.

Simons put it this way: "Even a crisis does not suspend the rule of Sierra Leonean government and politics, where information is power." This was especially true of the relationship between the Ministry of Health and the National Ebola Response Centre, which – though nominally partners – often acted as rivals.[64]

Others were more positive, but still pointed to challenges. Teran, for example, says that while the Sierra Leonean government in general collaborated well, the process for getting its data into HDX was not always *technically* straightforward.[65] Before data made its way onto HDX, it first had to pass from the government to WHO in the form of a report. WHO then captured the information, sent it to their headquarters in Geneva, and finally HDX gained access and was able to share the information on the platform. This extended process meant that while HDX had a direct line to data held by WHO, that data was not in fact real time.[66]

Lack of Existing Structures and Best Practice

Much of the effort to fight Ebola was done "on the fly," without the benefit of established procedures and practices. This made it substantially more difficult to mount an effective response. "[R]elationships and platforms should be established before a crisis happens so that you already have this relationship in place," says Dufour, of HIU.[67] Deparday of GFDRR agrees, arguing that "it's better to have a GeoNode deployed before crisis. It's definitely hard to deploy it in the midst of a crisis."

Perhaps surprisingly, the challenges arising from the "on the fly" GeoNode deployment were not primarily technical. Dufour and Deparday agree that setting up the platform and creating the technical infrastructure was in many ways the easy part. The difficult part was really in creating institutional frameworks, establishing relationships, and defining shared best practices and procedures that can be used by all responders.[68,69]

In the wake of the crisis, a panel of independent experts comprising the Ebola Interim Assessment Panel concluded that the lack of infrastructure and established best practices played a significant role in hampering the response. Among the conclusions reached by the panel were:[70]

- National surveillance activities need to be better integrated with existing components of health systems;

64   GovLab interview with Rupert Simons, Former Advisor to the African Governance Initiative; CEO Publish What You Fund, August 6, 2015.
65   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.
66   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Humanitarian Data Exchange, September 18, 2015.
67   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.
68   GovLab interview with Patrick Dufour, Former Senior Web GIS Developer, U.S. Department of State, Humanitarian Information Unit, December 17, 2015.
69   GovLab interview with Vivien Deparday, Disaster Risk Management Specialist, Open Data for Resilience Initiative Operational Deployment Lead, Global Facility for Disaster Risk and Reduction, World Bank, December 17, 2015.
70   "Report of the Ebola Interim Assessment Panel." World Health Organization. May 2015. http://www.who.int/entity/csr/resources/publications/ebola/report-by-panel.pdf?ua=1

- Data aggregation and sharing was often limited, or nonexistent;

- Stronger collaboration was required, in particular between the private and public sectors.

The Ebola crisis had much to teach the international humanitarian community. These and other lessons are now being digested, processed, and hopefully will inform responses to future crises.

V. LOOKING FORWARD

In many ways, the Ebola crisis has established a set of best practices for future data usage in response to humanitarian crises. The teams behind HDX and GeoNode have many plans for the future – how to grow their platforms, how to use them in other contexts and geographies, and how to make them even more effective. Here, we highlight just a few of the plans for HDX and GeoNode, and describe the fate of NERC.

HDX: Enabling New Insights into the Spread of Ebola

The experience of HDX in West Africa during the Ebola crisis is teaching lessons to people around the world. Researchers at MIT and the University of Virginia, for example, are using the platform to analyze how the virus spread in affected countries. This analysis will focus especially on the cultural factors that enabled the rapid spread of the virus – for example, the tendency for families in the region to come together when someone is sick, rather than avoiding the infected person.[71] Although no one is arguing for major cultural changes to occur – many people in Sierra Leone are unlikely to accept cremation, for example – researchers and HDX's organizers believe that analysis of the data found on the platform can help uncover ways to stop the virus' spread. One particularly important avenue of research involves the need for safer burial practices, which played a central role in spreading the virus.[72]

In general, says Teran, HDX is seeking to "facilitate" the flow of information to parties that can yield potentially lifesaving insights from the platform. These parties include a wide range of actors – individual university researchers, and media groups like the *New York Times*[73] and *National Geographic*.[74] The licensing system applied to the HDX data – users are allowed to profit from the use of the information as long as credit is given to the original data suppliers – lowers the potential barriers to wide use of the data even further.[75] It stands in many ways as a

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71   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Human-
        itarian Data Exchange, September 18, 2015.
72   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Human-
        itarian Data Exchange, September 18, 2015.
73   http://www.nytimes.com/interactive/2014/07/31/world/africa/ebola-virus-outbreak-qa.html
74   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Human-
        itarian Data Exchange, September 18, 2015.
75   GovLab interview with Javier Teran, Statistician, United Nations Office for the Coordination of Humanitarian Affairs, Human-
        itarian Data Exchange, September 18, 2015.

model for open sharing and collaboration around data, all in the interests of social change and improvement.

Next Steps for GeoNode

GeoNode's open nature results in "a very vibrant community with more and more people studying and contributing development."[76] As a result, the organizers "can't really keep track" of where it's going. Indeed, Deparday, speaking about GeoNode in general, notes that, "This is, I think, a really great success story about open source."[77] The GeoNode team, as of late 2015, is supporting around 20 active GeoNodes around the world. That number climbs to "a hundred or more if we are talking about people using it for their own use – people who have installed it for their university or their local governments."[78]

Perhaps the greatest impact of the Ebola GeoNode is still to come. Benson Wilder of HIU notes that, "There's a mind toward longer term management of the geospatial data and the ability to transfer the content and the governance to entities who will have an interest in using it and keeping it up to date."[79] This focus on governance is key for future GeoNode efforts, particularly around open data preparedness since, as Deparday makes clear, "technology is the easy part."[80]

The Closure of NERC

In November 2015, WHO declared Sierra Leone officially Ebola-free after the passage of 42 days without any new cases reported.[81] The next month, on December 31, 2015, NERC closed its doors. At that point, the Centre's responsibilities were distributed among the Ministry of Health and Sanitation (MoHS), the Ministry of Social Welfare and the Office of National Security.[82]

The closure of NERC was not welcomed by some in Sierra Leone. The Tanzanian newspaper *The Citizen* noted "skepticism" among the public as a result of "fear [that] the expertise within the institution can't be replaced."[83] The government, however, noted that the financial implications of maintaining NERC were too significant given the Centre's preponderance of international staff.[84]

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76   GovLab interview with Vivien Deparday, Disaster Risk Management Specialist, Open Data for Resilience Initiative Operational Deployment Lead, Global Facility for Disaster Risk and Reduction, World Bank, December 17, 2015.
77   GovLab interview with Vivien Deparday, Disaster Risk Management Specialist, Open Data for Resilience Initiative Operational Deployment Lead, Global Facility for Disaster Risk and Reduction, World Bank, December 17, 2015.
78   GovLab interview with Vivien Deparday, Disaster Risk Management Specialist, Open Data for Resilience Initiative Operational Deployment Lead, Global Facility for Disaster Risk and Reduction, World Bank, December 17, 2015.
79   Quinn, Kristin. "An Unprecedented Response: The GEOINT Community's Role in the Ebola Relief Effort." Trajectory Magazine. 2015. http://trajectorymagazine.com/government/item/1908-an-unprecedented-response.html
80   GovLab interview with Vivien Deparday, Disaster Risk Management Specialist, Open Data for Resilience Initiative Operational Deployment Lead, Global Facility for Disaster Risk and Reduction, World Bank, December 17, 2015.
81   O'Carroll, Lisa and Umaru Fofana. "WHO officially declares Sierra Leone Ebola-free." The Guardian. November 7, 2015. http://www.theguardian.com/world/2015/nov/07/world-health-organisation-sierra-leone-ebola-free
82   "Sierra Leone dissolves Ebola response centre." The Citizen. January 6, 2016. http://www.thecitizen.co.tz/News/Sierra-Leone-dissolves-Ebola-response-center/-/1840340/3022944/-/11h8g99z/-/index.html
83   "Sierra Leone dissolves Ebola response centre." The Citizen. January 6, 2016. http://www.thecitizen.co.tz/News/Sierra-Leone-dissolves-Ebola-response-center/-/1840340/3022944/-/11h8g99z/-/index.html
84   "Sierra Leone dissolves Ebola response centre." The Citizen. January 6, 2016. http://www.thecitizen.co.tz/News/Sierra-Leone-dissolves-Ebola-response-center/-/1840340/3022944/-/11h8g99z/-/index.html

Sadly, the body of a young woman tested positive for Ebola two months after the country was officially declared Ebola-free, and just two weeks after NERC's closure.[85] It remains to be seen whether this case will become anything more than a tragic, isolated setback in the country's recovery from the crisis.

The data-driven response to the Ebola crisis in Sierra Leone in many ways took on the character of the crisis itself – a massive, chaotic task involving a broad range of well-meaning actors who were attempting to improve conditions while facing significant challenges. Although the direct impact of efforts like the initiatives described here can be difficult to quantify, it is clear that data played a key role in placing relevant information into the hands of those who needed it and in helping address the Ebola crisis. It is equally clear that these initiatives offer best practices and pathways to those at the forefront of disaster response around the world. In many ways, the experience in West Africa can be considered a valuable proof-of-concept for the positive role of data and information in a variety of crises, man-made or natural.

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85   Searcey, Dionne and Sheri Fink. "Day After a Victory Over Ebola, Sierra Leone Reports a Death." The New York Times. January 15, 2016.

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