POLICY BRIEF

Identifying success factors in crowdsourced geographic information use in government

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Policy brief

This policy brief summarizes the findings of the research report "Identifying success factors in crowdsourced geographic information use in government" produced by the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR) in partnership with scholars from University College London (UCL). This brief explains the report's context, methodology, main findings and recommendations.

Introduction

The adoption of crowdsourced geographic data, or volunteered geographic information (VGI), as a valuable source of spatial data is growing at all levels of government. VGI is crowdsourced geographic information provided by a wide range of participants with varying levels of education, knowledge and skills.[1] Despite some initial concerns about data quality during early development of VGI approaches, extensive research now demonstrates that the reliability and accuracy of VGI is suitable for official or government use.[2] Such concerns should no longer be a reason for the lack of government adoption of VGI. Nonetheless, significant challenges remain for governments seeking to take full advantage of the benefits that crowdsourcing offer.

This research used a case study approach to understand factors that have contributed to the success of government VGI efforts, some of which include supportive organizational or legal contexts, the presence of local champions, and project design elements. The 50 case studies of government

Box 1: USGS activities

The US Geological Survey (USGS) is an example of an organization with a set of well-established crowdsourcing projects. These include base mapping with The National Map Corps, collecting data on bird migration with the North American Bird Phenology Program, and the "Did you feel it?" project that documents public experience of earthquakes.

National Map Corps project volunteers are asked to collect and edit data about human-made structures and provide accurate and authoritative spatial map data for the USGS National Geospatial Program's web-based 'The National Map'. Volunteers edit 10 different structure types in all 50 states, including schools, hospitals, post offices, police stations and other important public buildings.

The North American Phenology Project ran from 1880 until 1970 when it was discontinued due to lack of financial resources. In a new project, USGS is working with volunteers to transcribe its records, curate the data, and make it publicly available.

"Did you feel it?" asks volunteers to report how they experienced an earthquake. Contributors complete an online form to describe the impact, and their experience is quantified using the Modified Mercalli Intensity (MMI) scale. Contributors do not need to have experience in seismology. The project makes up for the paucity of instrumental ground-motion data in regions of low seismicity by providing a rich data pool of observations, which are analyzed and used in maps and graphics available to the public.

involvement with VGI spanned multiple sectors, including disaster risk management, urban planning, and environmental conservation. This report argues that, while there are no "one size fits all" approaches to successful project implementation, a number of common lessons can be gleaned from analysis of prior examples.

Volunteered geographic information in government

Government organizations, from the local to the national level, rely on geographic data for many of their operations, from planning new infrastructure development to maintaining order and responding to emergencies. For this reason, geographic information systems (GIS) are now commonplace in governmental operations. VGI, which has gained recognition as a novel source of data in the past decade, offers many advantages to governments who use GIS: VGI complements professional data collection by government agencies by providing data coverage for locations and time periods not addressed by official data collection initiatives (Box 1).

- VGI enables government agencies to capture and integrate local knowledge, which is not incorporated by official processes.
- Engaging the public in governmental processes, creating space for dialogue, and supporting efforts around transparency and data-driven decision making.
- In some cases, VGI can be a cost- and time-effective alternative to standard data collection.
- VGI approaches can support the development of beneficial community skills and capacities in areas such as preparedness for natural hazards (Box 3).

Identifying factors of success in VGI projects

The analysis behind this report was based on 50 case studies. Each case features:

- a government agency at local, regional, or national level
- public outreach with a request for individuals to share their knowledge (e.g. vernacular placenames) or to create new data (e.g. map a place)
- use of information and communication technologies
- a specific intended use for the information created.

The cases were coded according to a set list of characteristics (e.g. type of partnership, existence of an organizational champion). The analysis highlights six key elements of government VGI projects:

- incentives/drivers to start a project
- scope and aims of the project
- participants, stakeholders and partnerships
- inputs such as technical and financial resources or training
- technical and organizational aspects
- challenges encountered

The first five topics were analyzed further using Qualitative Comparative Analysis (QCA) (Box 2). We discuss the main findings in each of the elements below.

Incentives to start a VGI project

The organizations studied in this report were found to start VGI projects for several reasons, including the lack of institutional data in time sensitive situations such as disaster response; lack of resources for data collection; policy change around governmental data, particularly related to open data initiatives; research and development; and environmental monitoring through citizen science where members of the public work together with scientists to collect and analyze environmental information.

Box 2: Methodology

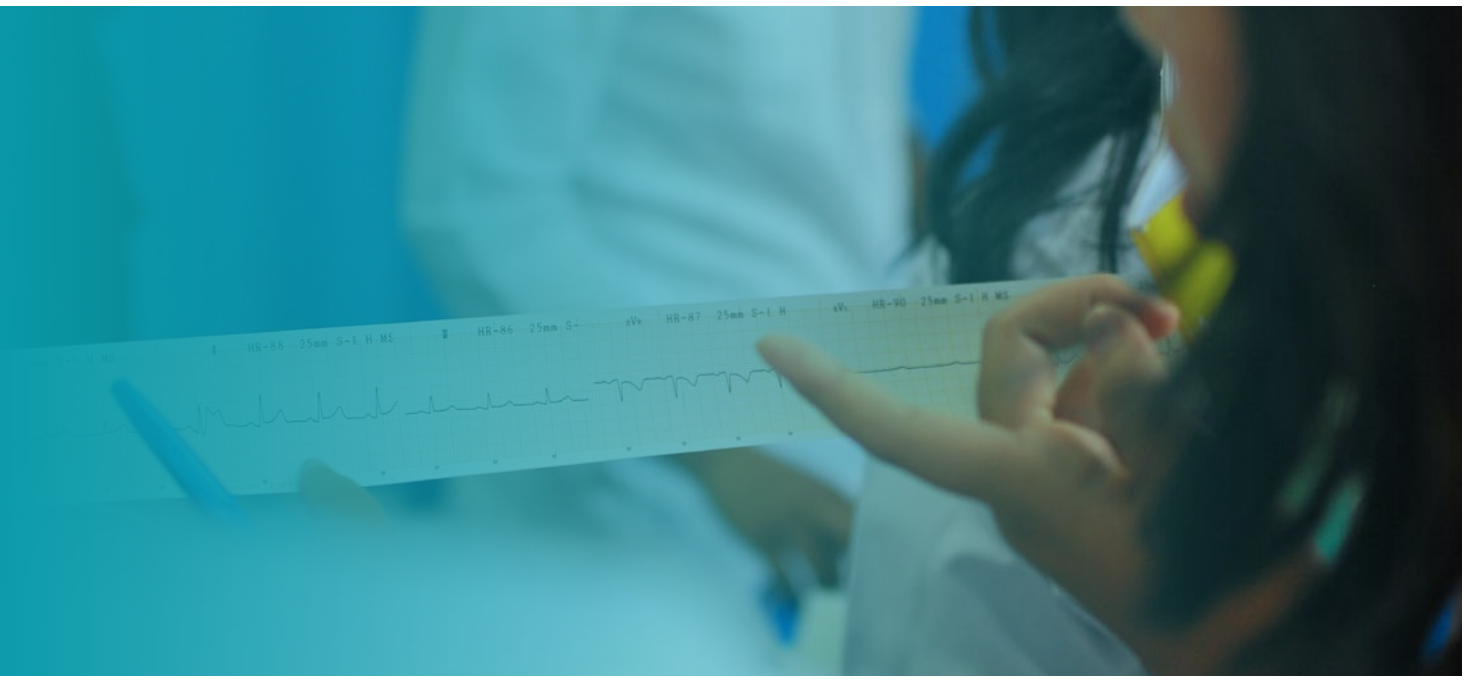
The following steps were taken to understand the scope of VGI projects in government:

An online survey about existing VGI projects in government was made available on a dedicated website, in consultation with GFDRR. The website already included 29 case studies from a 2014 report. Experts were asked to complete the survey or provide information about projects directly to the research team.

The report team identified and researched other new case studies.

72 new projects were identified and 21 selected for inclusion in the report (these were the most complete in terms of detail available), along with the 29 projects identified in 2014. In total, 50 cases were analyzed in depth and are detailed in the Appendix.

The case studies were compared and analyzed using Qualitative Comparative Analysis (QCA). QCA is a well-accepted analytical technique that uses Boolean algebra to compare and qualitatively study social phenomena. All cases were mapped against a detailed set of factors that could (positively or negatively) affect their outcome, and several QCA models were tested.



Analysis of these factors showed that, compared to other incentives, environmental monitoring through citizen science provided an especially strong foundation for successful VGI projects in government. In other contexts, open data policies provided opportunities for successful collaboration between government and the public around the maintenance or updating of authoritative datasets. Importantly, VGI projects that were driven by a lack of resources to create information for government operations, were only successful when there was also a commitment by the government to invest in internal capacity development or other sustainability measures. Without such an investment, they tended to be unsuccessful over the long term.

Scope and aims

The scope and aims of the case study projects fall into the following key categories: base mapping of an area of interest or entire country; updating authoritative datasets, such as the US National Map (Box 1); upgrading the quality of the services provided by a public sector organization; policy development or reporting on implementation; and disaster risk management and response.

The analysis showed that base mapping[3] was an important component of almost all successful cases. It was successfully combined with other aims such as disaster preparedness and response or public service improvement. Collection of base map data for the area of interest is thus considered to be an important part of successful VGI projects.

Participants, stakeholders and relationships

Most successful VGI projects involve cooperation amongst a range of partners and stakeholders. The analysis examined the range of partners in relation to the success of the VGI projects. Specifically, it examined combinations of public sector, private sector, international NGOs, local NGOs and research organizations, and considered the overall number of partners involved in the project.

Many successful projects included international NGOs, which highlights the effectiveness of NGOs with crowdsourcing experience working together with public bodies to achieve project goals. The resources of private sector organizations are valuable, but in our case studies, they were more successful when partnered with intermediaries, such as experienced NGOs.

The absence of local NGOs in our case studies might be explained by the observation that, apart from the area of environmental monitoring through citizen science, there are few well-established local NGOs with the expertise to act as VGI project champions. It is likely that, where they exist, they could play a similar intermediary role, as occurred in the aftermath of the 2015 Nepal Earthquake (Box 3).

Inputs

Governments can invest in VGI projects in a wide variety of ways. Project inputs included the release of existing data resources, such as through open data efforts; direct investment, for example, employing contributors or a government employee tasked with managing the project; investment in a new technology, such as a website or mobile app to facilitate contributions; development and delivery of training programs with key partners; and creating research and citizen science initiatives linked to government agencies.

The analysis showed that incentivizing contributions of either dedicated government staff time, or public participants, was employed by many successful projects when combined with the introduction of a new technology, such as a mobile data collection application. Training activities were also important determinants of project success, but in some cases these could be replaced by partnerships with expert communities.

Box 3: Open Cities Kathmandu

The Open Cities Kathmandu project was launched in 2013 to collect data on earthquake vulnerability using the OpenStreetMap platform. Nepal has long been recognized as one of the most at-risk countries in the world for earthquakes and other natural hazards. The Open Cities project created a partnership between local NGOs, the Nepal government, and several universities to perform detailed base mapping of Kathmandu and collect structural data for over 2000 schools and 350 health facilities for use in seismic risk assessment. At the conclusion of the project, local participants formed a new Nepali non-for-profit technology organization called Kathmandu Living Labs (KLL) which has continued working on projects related to open mapping and VGI. In the aftermath of the April 2015 earthquake in Nepal, both KLL and the OpenStreetMap platform played pivotal roles in supporting emergency response.

Technical and organizational aspects

The research also examined various technical and organizational aspects of VGI implementation within government programs. These aspects included the combination of VGI data with authoritative government data, concerns about accuracy and quality of VGI data, the intended use of VGI data, and the role of champions in the government entity.

The most important finding here was the need to formalize and standardize VGI before its use in government systems. The analysis showed that many successful projects combined the presence of an active government champion and mapping activities that were focused on creating new data (as opposed to maintaining existing, authoritative, data).

Other challenges

Some additional factors are also important in ensuring successful VGI projects in government. First, there should be careful consideration of whether the activity is designed as a one-off event or ongoing initiative. While many VGI activities are conceived as single events, the longevity of updates and maintenance remains relevant. Regardless of the length of the project, public interest and participation needs to be maintained through the life of a VGI project. Maintaining the data and relevant software is also a concern; therefore, resources should be allocated across the whole life of a project to support these activities.

Second, the quality of the VGI and its application are key considerations to be addressed at the beginning of the project, and revisited regularly throughout its lifecycle. Government agencies are responsible for providing authoritative data while also integrating public input, making accuracy and reliability areas of concern. There are multiple methodologies for quality assurance in VGI, which should be explored and integrated depending on the context and aims.

Summary of findings

The analysis identified key factors at several levels in successful established VGI projects in government.

At the **individual level**, champions and change leaders in public sector organizations are critical. Individuals who oppose public participation in data collection and analysis for reasons of information security or quality can block or hinder the integration of VGI into government. Discussions to understand and alleviate the concerns of such individuals can assist in the adoption of VGI.

At the **organizational level**, organizations that already rely on external sources for spatial data show a greater potential for VGI adoption because staff of government agencies that produce data may see the use of VGI as a threat to established modes of operation and sources of funding.

Further organizational issues can be procedural, such as existing legislation and service delivery obligations, or structural, such as responsibilities for data collection and use. This is linked to the need for having well-understood **business models** supporting the creation and maintenance of data, and consideration of how these will change with the introduction of VGI.

Technical challenges should be also noted. For example, the ability to merge datasets that have been changed by the public into existing government systems was found to be critical. This analysis suggests that governmental organizations new to VGI should use more mature technologies, or partner with experienced organizations on capacity building activities.

Finally, **conceptual or "worldview" issues** need to be recognized, as they also interact with the above categories. The adoption of VGI requires accepting a higher level of uncertainty, attention to heterogeneity, collaboration among diverse groups of participants, different ways of communicating with the public, and different operating procedures. For example, quality assurance procedures that are suitable for in-house process are methodologically unsuitable for the VGI context. Overall, government staff must be open to adjusting their beliefs about "how things are done".

Other Recommendations

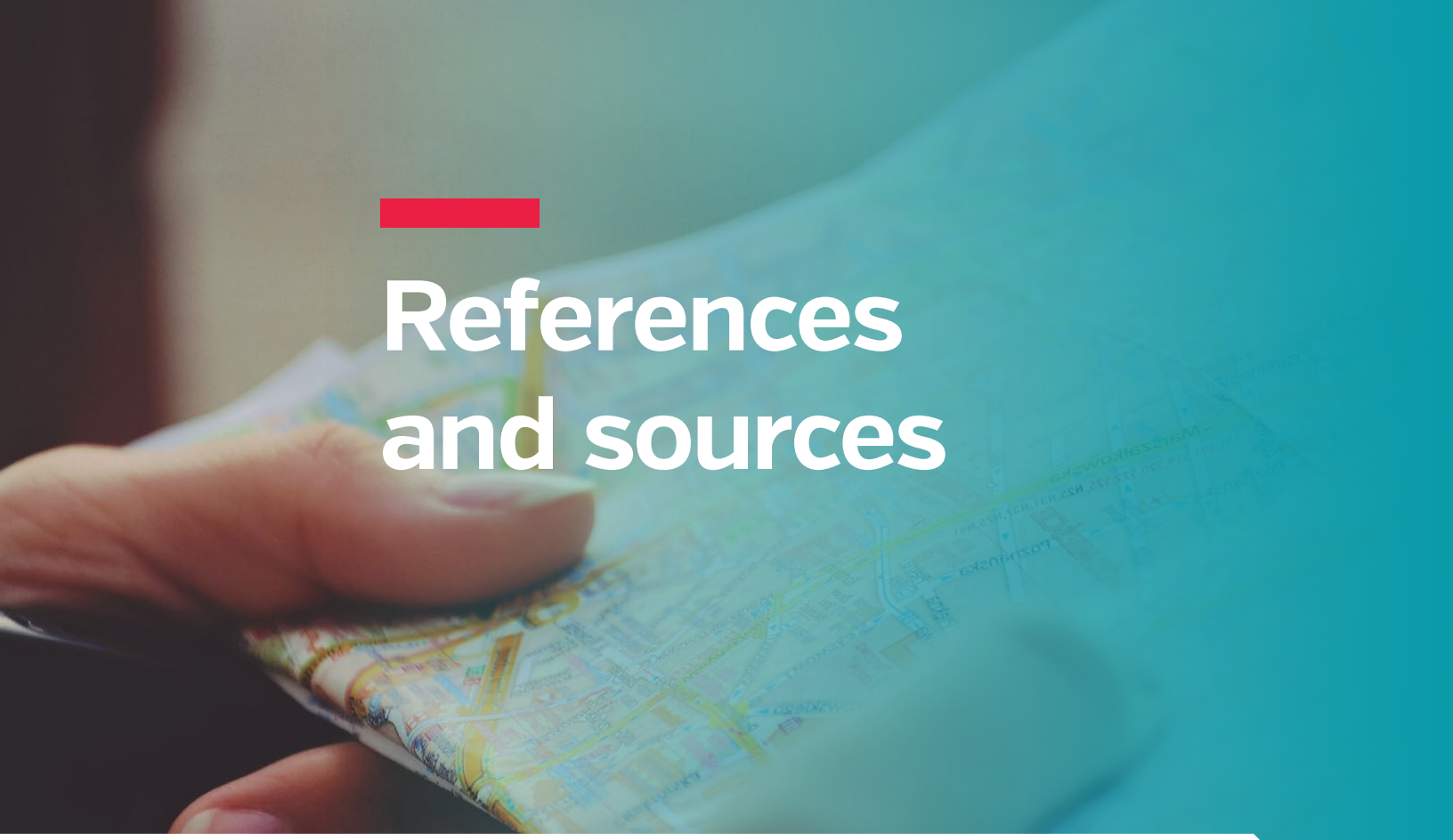
In addition to the findings summarized above, the findings of the study also suggest that projects seeking to help government entities take advantage of the potential that VGI offers should:

- Identify and support an organizational champion.
- Consider a project focused on improving public services or environmental monitoring as these have been particularly successful in adopting VGI approaches.
- Aim to collect base map data or basic information, instead of attempting to update authoritative datasets.
- Dedicate appropriate resources. Using new technology requires significant investment beyond building the technology itself, and using established technology with a training program can be effective.
- Engage with a local or international NGO that has experience facilitating VGI projects, or link with other government agencies that have experience in this area.
- Plan to address the organizational, technical and worldview challenges within the government entity in order to gain support for VGI across the organization.

1 The term VGI was established by Michael Goodchild in 2007, in his paper, "Citizens as sensors: the world of volunteered geography". The terms crowdsourced geographic information and VGI are often used interchangeably.

2 For example, see Haklay, M. (2010). How Good is Volunteered Geographic Information?

3 The creation of the basic elements of mapping – streets and roads, public buildings and facilities, major landmarks and natural features



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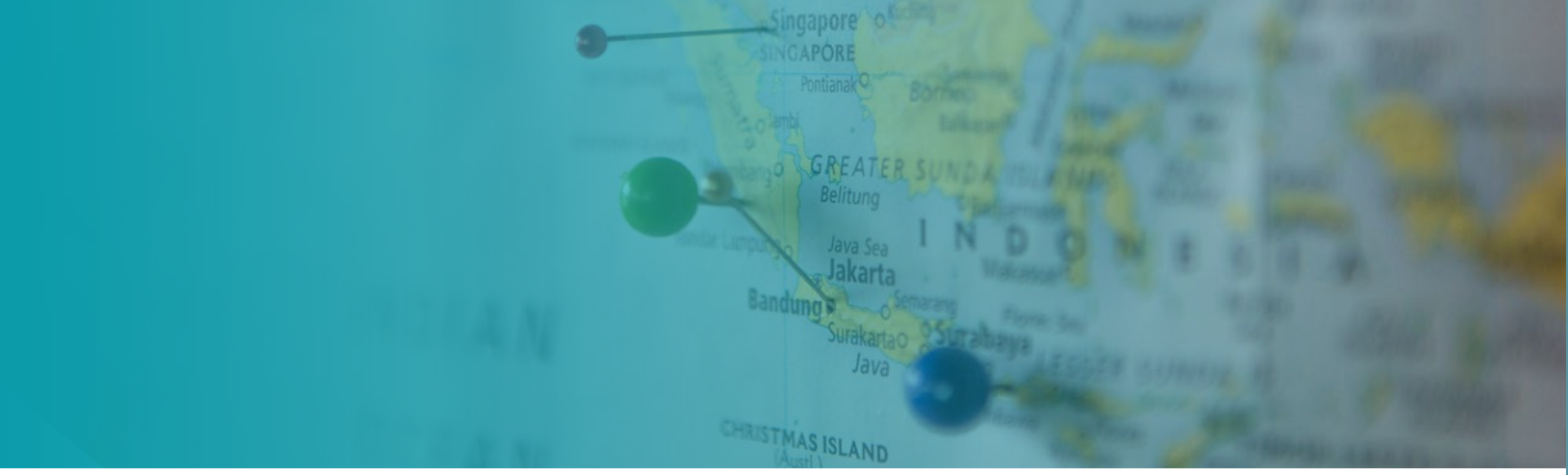

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