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OPEN DATA IN DEVELOPING ECONOMIES

Toward Building an Evidence Base on What Works and How

Stefaan G. Verhulst and Andrew Young
The GovLab

JULY 2017

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ABOUT THE GOVLAB

The Governance Lab (GovLab) is an action research center based at New York University. Our work seeks to build evidence on how to strengthen the ability of institutions and people to work more openly, collaboratively, effectively, and legitimately to make better decisions and solve public problems. GovLab studies and curates new findings relevant to institutional innovation, and develops and tests new methodologies for institutions to solve problems in a more open and collaborative manner. To increase the innovation capacity of institutions, GovLab also trains public entrepreneurs in new approaches to tackle societal challenges, and builds networks of innovators to help match the supply of expertise present in society to demand in the form of public problems.

ABOUT THE AUTHORS

Stefaan G. Verhulst is Co-Founder and Chief Research and Development Officer of the GovLab where he is building a research foundation on how to transform governance using advances in science and technology. @sverhulst

Andrew Young is the Knowledge Director at The GovLab, where he leads research efforts focusing on the impact of technology on public institutions. Among the grant-funded projects he has directed are a global assessment of the impact of open government data; comparative benchmarking of government innovation efforts against those of other countries; and crafting the experimental design for testing the adoption of technology innovations in federal agencies. @_AndrewYoung

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EXECUTIVE SUMMARY

Across the world, governments are acting on the belief that systematically making data more accessible can provide an important new asset to usher in positive social and economic transformation. This trend is not limited to countries with more developed economies. Although the bulk of data in terms of quantity has thus far been released in developed countries, a growing number of developing economies — in Asia, in Africa, in Latin America — have also been adopting open data plans and policies, and publishing government datasets that previously remained locked away in closed databases. This move toward open data is part of a broader global trend toward more data-driven decision making in policymaking and development — a manifestation of what is sometimes called the "data revolution."

The growing enthusiasm surrounding open data gives rise to several questions about open data's unique features to foster change. Can it truly improve people's lives in the developing world — and, if so, how and under what conditions?

The goal of this paper is to map and assess the current universe of theory and practice related to open data for developing economies, and to suggest a theory of change that can be used for both further practice and analysis. We reviewed the existing literature, consulted with the open data community and sought to collect evidence through a series of 12 in-depth case studies spanning multiple sectors and regions of the world. In particular, we sought to answer the following three questions:

What makes open data uniquely relevant to developing economies?

How can the impact of open data in developing economies be captured and evidence be developed?

How can open data be leveraged as a new asset for development?

WHAT MAKES OPEN DATA UNIQUELY RELEVANT TO DEVELOPING ECONOMIES?

Although there has been much focus on the potential of data to usher in change, what makes open data different is often not as well recognized, with supporting analysis often speculative or anecdotal. Understanding the distinguishing features of open data is important to subsequently document how open data works — its mechanisms and pathways — and in doing so, to build a more solid evidence foundation for open data in development. Based on our review of the existing narratives and theories in the literature, we identified six unique features that are believed to make open data specifically relevant — or potentially powerful — in the context of developing countries. They reflect some of the features that are often also associated with the value of open source or open innovation in a developing context; and explain why open data is closely connected with the twin trends of open government and open development.

HOW CAN THE IMPACT OF OPEN DATA IN DEVELOPING ECONOMIES BE CAPTURED AND EVIDENCE BE DEVELOPED?

To analyze and capture existing evidence and to inform future comparative analyses across sectors and countries, we developed, expanded, and sought to start testing the following Change Theory and/or Logic Model:

Open data (supply), when analyzed and leveraged by both governmental and non-governmental actors (demand), can be used in a variety of ways (actions and outputs), within the parameters established by certain enabling conditions (and disabling factors), to improve government, empower citizens and users, create economic opportunity, and/or solve societal problems (impact).

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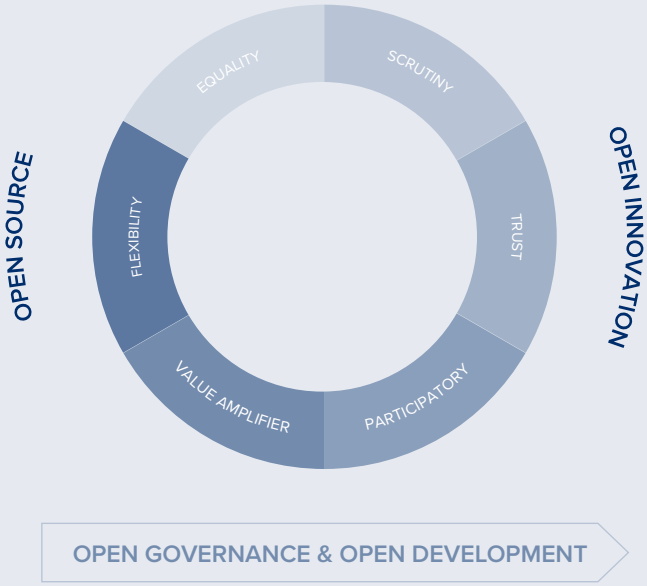
THE UNIQUE FEATURES OF OPEN DATA



Participation
By facilitating citizen participation and mobilization, open data can allow a wider range of expertise and knowledge to address and potentially solve complex problems.

Trust
Because open data increases transparency and avenues for citizen oversight, unlocking data can lead to higher levels of trust throughout societies and countries.

Equality
Open data can lead to more equitable and democratic distribution of information and knowledge — though, several observers have also pointed out that just releasing open data can play a role in further entrenching power asymmetries related to access to technology and data literacy.

Scrutiny
Because open data is subject to greater scrutiny and exposure than inaccessible institutional data, there is potential for enhanced review and improvement in the quality of government data by actors outside government.

Value Amplifier
Opening government datasets in a flexible and equal manner can amplify the value of data by filling — and identifying — important data gaps in society.

Flexibility
When released in an interoperable, machine-readable manner, open data is easier to repurpose and combine with other pieces of information, which in turn means that it is more flexible, with secondary data potentially yielding innovative insights.

LOGIC MODEL OF OPEN DATA

This logic model is built around the premise (informed by the case studies) that high-impact open data projects are the result of matching supply and demand so that open data can be effectively used to inform specific activities and outputs aimed at improving development. These outputs and activities can, in turn, serve a broader and more diverse group of users and objectives.

We categorized open data's (intended or realized) impact on development along the following pathways:

- **Creating economic opportunity,** by enabling business creation, job creation, new forms of innovation, and more generally spurring economic growth
- **Helping to solve complex public problems** by improving situational awareness, bringing a wider range of expertise and knowledge to bear on public problems, and by allowing policymakers, civil society, and citizens to better target interventions and track impact
- **Improving governance,** for instance by introducing new efficiencies into service delivery, and increasing information sharing within government departments
- **Empowering citizens** by improving their capacity to make decisions and widen their choices, and by acting as a catalyst for social mobilization

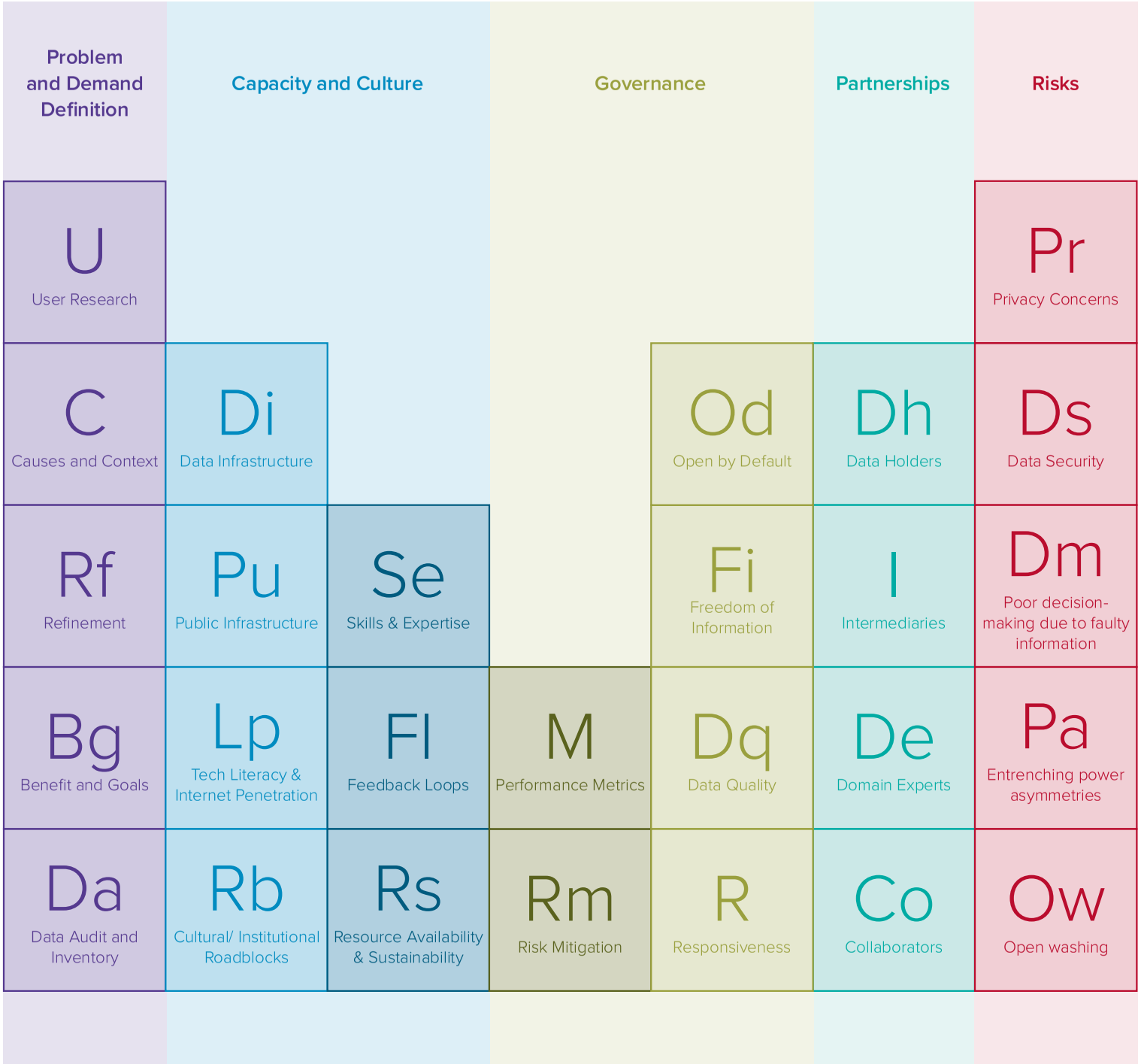
We found that there is wide variability of documented evidence. Much of the literature remains focused on the potential of open data to bring about positive benefits — absent real evidence and data. Little distinction is made between intent, implication, and impact, blurring our understanding of what the true value may be of open data. Several of the cases we analyzed did provide evidence that open data had an impact on people's lives while some failed to achieve notable, scalable impact, or worse, created new harms or risks.

To address the variability in evidence, and start focusing on testable premises of how, and under what conditions, open data works best in developing economies, we subsequently identified 27 enabling or disabling factors within the following five categories:

- **Problem and Demand Definition:** whether and how the problem to be addressed and/or the demand for open data are clearly defined and understood
- **Capacity and Culture:** whether and how resources, human capital, and technological capabilities are sufficiently available and leveraged meaningfully
- **Partnerships:** whether collaboration within and, especially, across sectors using open data exist
- **Risks:** whether and how the risks associated with open data are assessed and mitigated
- **Governance:** whether and how decisions that affect the use of open data are made in a responsive manner

By combining these factors we developed a "Periodic Table of Open Data's Impact Factors" that can be used (and further fine-tuned) as a canvas or checklist toward designing open data initiatives. Together with the logic model, the periodic table can also be used as a framework for analyzing and capturing key evidence of what contributes to "successful" open data efforts in developing economies.

PERIODIC TABLE OF OPEN DATA IMPACT



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HOW CAN OPEN DATA BE LEVERAGED AS A NEW ASSET FOR DEVELOPMENT?

Despite the variability in evidence, we identified several key take-aways enabling us to make the following specific recommendations for open data practitioners and decision makers, including donors like USAID, on how to better leverage open data as a new asset for development.

Focus on and define the problem, understand the user, and be aware of local conditions. The most successful open data projects are those that are designed and implemented with keen attention to the nuances of local conditions; have a clear sense of the problem to be solved; and understand the needs of the users and intended beneficiaries. Projects with an overly broad, ill-defined or "fuzzy" problem focus, or those that have not examined the likely users, are less likely to generate the meaningful real-world impacts, regardless of funds available. Too often, open data projects have less impact because they are overly data-focused rather than problem- and user-focused.

Focus on readiness, responsiveness, and change management. Implementing open data projects often requires a level of readiness among all stakeholders, as well as a cultural transformation, in the way governments and institutions collect, share, and consume information. For development funders, however, this important determinant of success can imply difficult decisions regarding high-potential open data initiatives in developing economies that lack clear institutional readiness or demonstrated responsiveness to feedback.

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Nurture an open data ecosystem through collaboration and partnerships. Data does not exist in isolation. The success of open data projects relies on collaboration among various stakeholders, as well as collaboration with data scientists and topic or sector experts. During the problem definition and initial design phase, practitioners and funders should explore the types of collaborations that could increase uptake and impact. Such partnerships could, for example, take place with other data providers (perhaps from different sectors), like-minded international or local organizations, and established intermediaries such as journalists or industry groups.

Have a risk mitigation strategy. Open data projects need to be mindful of some of the important risks associated with even the most successful projects. Notably, these risks include threats to individual privacy (for example, through insufficiently anonymized data or commingling multiple datasets to create new privacy issues), and data security. Funders should ensure that projects that deal in information that is potentially personally identifiable (including anonymized data) have audited any data risks and developed a clear strategy for mitigating those risks before proceeding with the project.

Secure resources and focus on sustainability. Open data projects can often be initiated with minimal resources, but require funding and additional sources of support to sustain themselves and scale up. It is important to recognize that access to funding at the outset is not necessarily a sign that open data projects are destined for success. A longer term, flexible, business model or strategy is a key driver of sustainability, and should be developed in the early stages of the design process.

Build a strong evidence base and support more research. As demonstrated in this paper, of perhaps even greater importance is the development of an evidence base that can provide feedback and indications of what works and what doesn't work, to maximize the impact of the (often scarce) resources available. The analytical framework provided in this report could act as a starting point for developing more systematic and comparative research that would allow for more evidence-based open data practice. In addition, to turn insights gathered into more evidence-based practice we need to translate these findings into new methodologies or checklists of key steps and variables (leveraging the Periodic Table provided in this paper).

In conclusion, given the nascent nature of existing open data initiatives, the signals of open data's impact in developing economies are still largely muted, as evidenced in the examples discussed in our paper. Our goal in this paper was not to use these examples as the ultimate proof of open data's importance for development; rather, we have picked up these signals and placed them into an analytical framework to enable further practice and analysis going forward. It is only with this type of structured analysis that we can gain a systematic and comparative evidence base of if and how open data is having meaningful impact on conditions on the ground in developing economies.

THE OPEN DATA FOR DEVELOPING ECONOMIES CASE STUDIES

In this table, we list the case studies developed to inform this paper, identify the intended impact of each, and note which of the key take-aways described above are represented in the projects studied.

Case Study	Summary	Intended Impact	Clear Problem Definition	Readiness, Responsiveness and Change Management	Open Data Ecosystem and Partnerships	Risk Mitigation Strategy	Resources and Sustainability
Burundi: Open Results and Performance-Based Financing	Results-based financing (RBF) in Burundi is an instrument that links development financing with pre-determined results, aimed to strengthen accountability and transparency in government expenditure.	Improving Government	✓	✓	✓		✓
Cambodia: Opening Information on Development Efforts	Open Development Cambodia helps to improve the public's awareness of current and historical information on development efforts through a data-driven online platform.	Improving Government		✓	✓		✓
Colombia: Establishing Climate Resilience in Agriculture	The Aclímate Colombia project processes, analyzes, and publishes open government datasets to help farmers access climate and market data to improve their decision making and livelihoods.	Creating Opportunity	✓	✓	✓		
Ghana: Empowering Smallholder Farmers	Esoko is a for-profit communication tool that provides farmers repackaged data from different sources (including government and crowd-sourced data) via mobile phones to empower smallholder farmers.	Creating Opportunity	✓	✓	✓		✓
India: Open Energy Data	The Electricity Supply Monitoring Initiative (ESMI) collects real-time power quality information in an effort to monitor power quality in urban and rural India.	Improving Government	✓	✓		✓	✓
Jamaica: Open Data to Benefit Tourism	Jamaica uses open data to increase and improve its tourism sector, particularly by combining crowdsourced mapping data with open government data to create more participatory tourist maps.	Creating Opportunity	✓		✓		✓

Case Study	Summary	Intended Impact	Clear Problem Definition	Readiness, Responsiveness and Change Management	Open Data Ecosystem and Partnerships	Risk Mitigation Strategy	Resources and Sustainability
Kenya: Improving Voter Turnout with Open Data	In the lead up to Kenya's 2013 general election, Code 4 Kenya published election data on the website GotToVote!, which provided citizens with voter registration center information, and easy-to-access information about registration procedures.	Empowering Citizens	✓	✓	✓	✓	
Nepal: Open Data to Improve Disaster Relief	A number of crowdsourced and open mapping data platforms helped humanitarian relief efforts in the wake of Nepal's 2015 earthquake.	Solving Public Problems	✓	✓	✓	✓	✓
Paraguay: Predicting Dengue Outbreaks with Open Data	The National Health Surveillance Department of Paraguay opened data related to dengue morbidity, which was used to create an early warning system.	Solving Public Problems	✓			✓	
South Africa: Code4SA Cheaper Medicines for Consumers	Code for South Africa uses data from the National Department of Health for its Medicine Price Registry Application (MPRApp), an online tool that helps patients identify and access cheap medicine.	Empowering Citizens	✓	✓	✓		
Tanzania: Open Education Dashboards	Two portals in Tanzania publish education data in efforts to improve Tanzania's schools. The first, the Education Open Data Dashboard (educationdashboard.org), supports open data publication, accessibility and use. The second, Shule (shule.info), attempts to use open data to catalyze social change in Tanzania.	Empowering Citizens		✓	✓		
Uganda: Opening Health Data to Improve Outcomes	Uganda's iParticipate project uses open data available from government portals and other sources to analyze health service delivery and public investments in health projects.	Improving Government	✓	✓	✓		✓

LIST OF ACRONYMS

BBW	Banana Bacterial Wilt
BODI	Burkina Open Data Initiative
CIAT	International Center for Tropical Agriculture
DFID	Department for International Development, United Kingdom
EITI	Extractive Industries Transparency Initiative
ELOG	Elections Observation Group
EOSDIS	Earth Observing System Data and Information System
ESM	Electricity Supply Monitor
ESMI	Electricity Supply Monitoring Initiative
EITI	Extractives Industries Transparency Initiative
GODAN	Global Open Data Initiative for Agriculture and Nutrition
IDRC	International Development Research Centre
IEBC	Independent Electoral and Boundaries Commission, Kenya
IMCO	Mexican Institute for Competitiveness
MERC	Maharashtra Electricity Regulatory Commission
MPR	Medicine Price Registry, South Africa
MPRApp	Medicine Price Registry Application
NERC	National Ebola Response Centre
NGO	Non-Governmental Organization
OD4D	Open Data for Development
ODC	Open Development Cambodia
ODI	Open Data Institute
OGP	Open Government Partnership
OSM	Open Street Map
PEG	Prayas Energy Group
PHC	Primary Health Care Centre
PII	Personal Identifiable Information
RBF	Results Based Financing
SDG	Sustainable Development Goals
TAP	Transparency, Accountability and informed Participation
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
WOUGNET	Women of Uganda Network

Matt Jones - Unsplash

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This paper was authored by Stefaan G. Verhulst and Andrew Young of the GovLab.

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Can open data bring about economic growth and social transformation? Can open data truly improve people's lives in the developing world—and, if so, how and under what conditions?

This paper's goal is to take stock of what is known about open data's use and impacts in developing economies, and to distill a theory of change based on existing theory and practice that can inform future open data use and research, as well as the enabling and disabling conditions that play a role in determining whether such impact is positive, negative (or negligible), seeking to understand what makes open data projects work or fail.

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INTRODUCTION

In 2009, the United States launched the data.gov portal. Since then there has been a rapid increase in the systematic opening of government data around the world. The 2016 Open Data Barometer,[1] published annually by the World Wide Web Foundation, found that 79 of the 115 countries surveyed had official open data initiatives, and many others indicated imminent plans to establish such initiatives. Similarly, as part of the Open Government Partnership (OGP), a multilateral network established in 2011, some 70 countries have now issued National Action Plans, the majority of which contain strong open data commitments designed to foster greater transparency, generate economic growth, empower citizens, fight corruption, and more generally enhance governance. Approximately half of these countries are from the developing world[2], suggesting the uptake of open data is happening not only within economically advanced countries, but also in those less developed. All of this is part of a general move toward more transparent and innovative governance mechanisms, as emblematized by rising interest in notions of open government and open development.

The growing enthusiasm for, and use of, open data in developing economies leads to several questions about open data's role in fostering development.[3] Can open data bring about economic growth and social transformation? Can open data truly improve people's lives in the developing world — and, if so, how and under what conditions? This paper's goal is to take stock of what is known about open data's use and impacts in developing economies, and to distill a theory of change based on existing theory and practice that can inform future open data use and research. This paper neither serves as a booster nor as a skeptic regarding the potential of open data in developing countries. Rather, it aims to sift through the evidence, draw out cross-cutting signals and insights from practice across developing economies when present, and start identifying the conditions under which open data appears able to work best, as well as those conditions that impede its potential.

METHODOLOGY

To formulate answers to the above questions and devise a theory of change, the authors undertook an extensive research effort that comprised a desk review of existing literature and identification of dozens of active open data projects around the developing world. From among these projects, the research team selected 12 case studies based on geographic and sector relevance. Each case study included further document review and consultations and interviews with project stakeholders over the course of three months. The outputs of these efforts and this final paper were reviewed and informed by an advisory group of open data for development experts and a group of open data peer reviewers. Throughout the paper, examples from these case studies (summarized in Appendix A) are employed to illuminate the real-world impacts of open data, when they exist, as

well as the enabling and disabling conditions that play a role in determining whether such impact is positive, negative — or negligible.

In developing a change theory and identifying meaningful answers to the above organizing research questions on the impact of open data, this paper builds upon existing studies and analyses about the relationship between open data and development.[4]

LIMITATIONS

The primary objective of this research was to capture the universe of current narratives and evidence of open data for developing economies. We found that the literature remains largely focused on the potential of open data to bring about positive impacts. In many instances, the benefits of open data are celebrated despite little concrete evidence to prove that opening data has in fact created positive on-the-ground impacts at a meaningful scale. In addition, when evidence is being presented, little distinction is made between intent, implications, and impact. As such, this paper does reflect the positive narrative provided by the literature on open data for developing economies, but does so to help identify a meaningful signal in the noise, and provide an analytical framework to enable others to build on our work and further crystallize the true impacts and drivers of successful open data initiatives in developing economies. Our aim is to enable the field to move from ideology to evidence; we see this paper as an initial step toward that end.

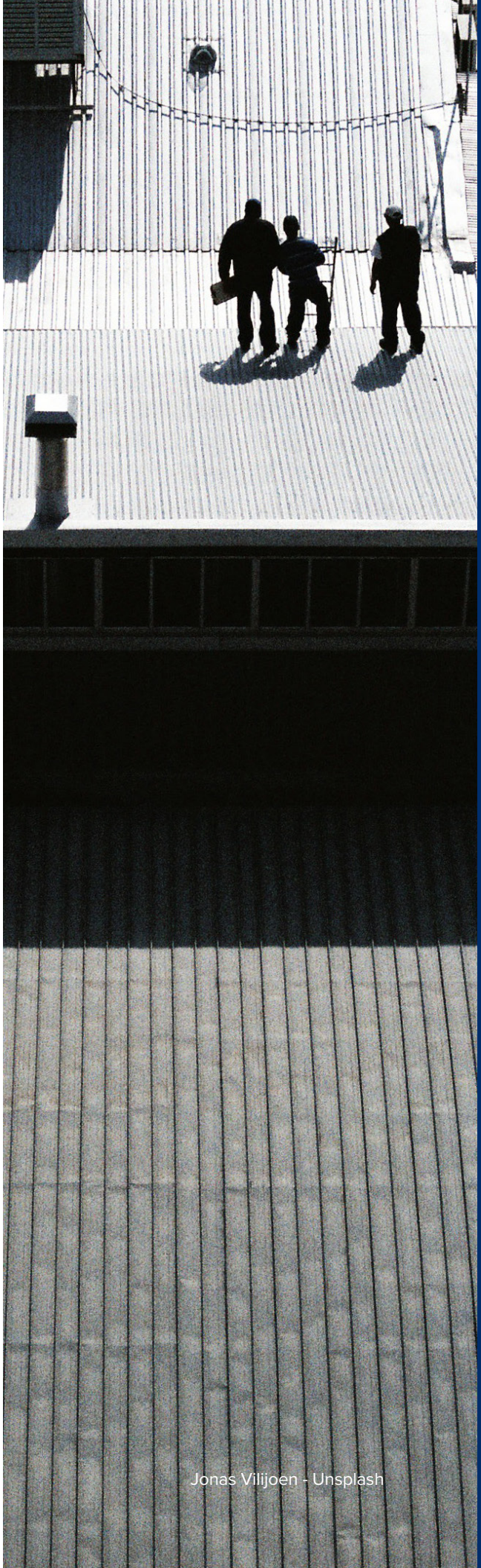
Before considering the (variable) evidence, it is important to note that "developing economies" are not uniform or monolithic. Our analysis focuses particularly on low- and medium-income countries, spread primarily across Africa, Latin America, and Asia. We do believe that some of the examples and evidence presented could be helpful in informing discussions and efforts underway in other contexts and countries. But questions of replication and scalability are complex — particularly when considering technological interventions — and we make no claims that the lessons offered here are universal, or even universally applicable across the diversity of countries that could be classified as low or medium income. So although this paper seeks to provide a set of testable research-driven premises and useful recommendations for open data practitioners and funders working across the developing world, it remains essential to always consider a country's local context and needs when seeking to replicate success stories or implement recommendations found in this paper.

PAPER CONTENTS

In essence, the paper seeks to answer the following key questions

- What makes open data uniquely relevant to developing economies?
- How can the impact of open data in developing economies be captured and evidence be developed?
- How can open data be leveraged as a new asset for development?

Toward that end the paper begins, in Part I, by providing a brief assessment on the theories and narratives of open data in development. In Part II, we present a change theory and a logic model to capture and develop evidence on open data in developing economies; these focus on enabling and disabling conditions, seeking to understand what makes open data projects work — or fail — to guide developing and funding open data initiatives in developing economies. Part III builds on the logic model presented in Part II with a focus on taking stock of open data's impacts across various development sectors. The paper concludes with a set of key take-aways and recommendations for aid organizations, governments, private sector entities, and others that are considering replicating or using open data as an asset for development.



Jonas Vilijoen - Unsplash

In this paper, we focus mainly on the release and use of government data. We acknowledge, however, the importance and often untapped potential of more open access to science data and corporate data.

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I. WHAT MAKES OPEN DATA UNIQUELY RELEVANT TO DEVELOPING ECONOMIES?

WHAT IS OPEN DATA?

In this paper, open data is defined as follows:

> *Open data is publicly available data that can be universally and readily accessed, used and redistributed free of charge. It is structured for usability and computability.*[5]

Not all forms of data shared actually possess all the attributes included in this definition, nor do they necessarily conform to all the principles found in the Open Data Charter.[6] In many ways, this is a gold-standard definition of open data, an important target to work toward. In fact, the openness of data exists on a continuum, and many forms of data that are not strictly "open" in the sense defined above are nonetheless shareable and usable by third parties. It is this broader sense of "open" that is used in this paper.

Open data exists in a wide variety of fields and domains. Three sectors in particular are responsible for producing the bulk of open data: governments, scientists, and corporations. In this paper, we focus mainly on the release and use of government data. We acknowledge, however, the importance and often untapped potential of more open access to science data and corporate data. Those other data sources, as well as crowdsourced data collection are also often mashed up with open government data, supplementing official public datasets to create new insights, opportunities, and impacts as a result. In what follows, we deconstruct the main reasons why open government data matters to developing economies.

The literature on open data reflects considerable enthusiasm about the potential for open government data in development. For example, a recent report published by the Open Data for Development Network suggests that open data is central to the development community's goals of "enabling widespread economic value, fostering greater civic engagement and enhancing government transparency and accountability to citizens." The report goes on to argue that "open data is increasingly recognized as a new form of infrastructure that is transforming how governments, businesses, and citizens are organized in an increasingly networked society."[7] We do find some evidence to support such enthusiasm: across sectors, we see signs that open data can indeed spur positive economic, political, and social change. On the other hand, we also find grounds for caution; the impacts of many of the projects we examined remain largely aspirational or speculative, and some cases even led to harms (or potential harms). Although the real-world impacts of open data in developing economies remain emergent, it is important to distill these early lessons and develop a frame of analysis to support the current window of opportunity to increase access to data sources — a window that is likely to close absent any further evidence of open data's impact or a better, more targeted description of the value proposition and change theory driving the field.

Denys Nevozhai - Unsplash

WHAT MAKES OPEN DATA UNIQUELY RELEVANT TO DEVELOPING ECONOMIES?

We live in an era of big data. Every day, an unprecedented amount of information is being generated by an ever-increasing diversity of devices and appliances. Today, a growing consensus exists that this data, if applied correctly, and with attention to the attendant risks, can help spur positive social change. Sometimes called the "data revolution,"[8] this new paradigm often fails to distinguish between the benefits of data per se and the complementing benefits of unlocking government data.[9]

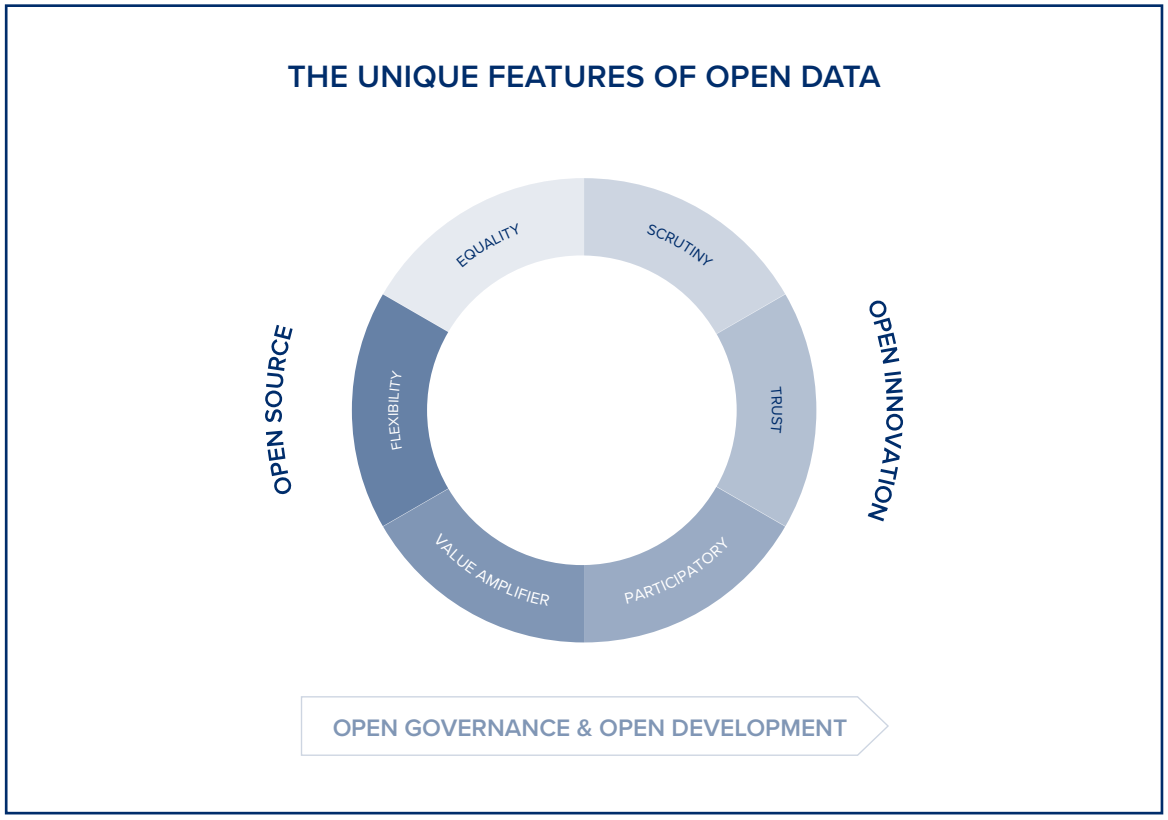

Figure 1: The Unique Features of Open Data

Based on our examination of the narratives and evidence provided in the existing literature, six distinguishing features seem to be credited to open data. Although these characteristics are unique to open data, in many cases, they would not be possible without a broader data, technology, and innovation ecosystem. Across our case studies, we've seen that the existence of a strong information and communication technology for development (ICT4D) sector in a country, for example, tends to result in higher impact, more quickly developing open data efforts.

With the understanding in mind that open data must exist in a strong ecosystem, the six distinguishing features that are most quoted with regard to open data in a development context include:

Scrutiny

Because open data is subject to greater scrutiny and exposure than inaccessible institutional data, there is potential for enhanced review and improvement of government data quality (e.g., by data-literate civil society groups or other crowdsourced methods). This can result in more useful data — again, a benefit that is relevant in less developed countries and societies, where data is scarce, and of limited quality and usefulness.[10]

Equality

Open data can lead to an inherently more equitable and democratic distribution of information and knowledge. This is a key intended benefit in all countries, but particularly salient in many developing economies that struggle with large socio-economic and digital divides.[11] It is important to keep in mind, however, that the lack of Internet penetration and access to tools for using and accessing open data still present challenges in many contexts — and, indeed, such technological inequities can be further entrenched through open data in some cases.

Flexibility

Open data is open with regard not only to the information it contains, but also to its format. This means that, when released in a usable manner, open data can be easier to repurpose and combine with other pieces of information than data institutions fail to make accessible, which in turn means that it is more flexible, with secondary uses that are likely to yield innovative insights. This is true of data from all sectors, but perhaps especially of government data, which often exists in vast, untapped silos; opening that data (turning it "liquid") can play a key role in generating new insights and policies.[12] Such liquidity can only become a reality if data, and the tools used to manipulate it, are interoperable and adhere to agreed upon standards. Creating such technical capacity can, however, lead to opportunity costs and require significant upfront resource allocation on the supply side, potentially slowing progress at the outset.

Participation

By facilitating citizen participation and mobilization, open data can allow a wider range of expertise and knowledge to address and potentially solve complex problems. This quality of "open innovation" can allow resource-starved developing economies to access and benefit from the best global minds and expertise. It can offer a more participatory way of solving complex public dilemmas, with pathways toward more easily tapping into previously inaccessible knowledge (e.g., those related to social and economic development).[13]

Les Anderson - Unsplash

Trust

Because it increases transparency and avenues for citizen oversight, unlocking data can lead to higher levels of accountability and trust throughout societies and countries.[14] This "sunlight" or "trust" quality of open data can have powerful ripple effects, including incentives for better government practice, and the enhancement of the quality of public life and citizenship. Such increases to trust and accountability rely on meaningful data being made open, however, rather than governments participating in "open washing" where largely useless datasets are made accessible toward boosting institutional reputation.

Value Amplifier

Finally, it is now widely recognized that data is a new kind of asset or knowledge is a form of wealth. The opening of government datasets in a flexible and equitable manner can amplify the value of data thanks to data filling important data gaps felt in society. Though this attribute is important across the world, it may have a particularly important role to play in developing economies. In its 2016 World Development Report, The World Bank pointed out that technology can play an "accelerator" role in developing countries.[15] But while the inherent scarcity of resources (data and otherwise) in the developing world increases the apparent value and potential impact of open data, cultural and political barriers to timely and well-targeted open data provision efforts could slow progress.

These narratives surrounding the open data movement reflect those associated with the cross-sector paradigm shift from closed processes to open ones, and how it applies to governance and development. Software, for example, is increasingly developed in an open source manner. With the rise of the collaborative coding platform GitHub, a notable driver,[16] the open source movement, similar to open data, is seen to be providing for more equal and flexible ways to create and access code — resulting in distributed coders, not just tech company employees, creating and improving exciting new products. Similarly, businesses and governments alike are embracing open innovation techniques, posing opportunities to the crowd to provide input on important challenges and absorbing the best ideas — providing for enhanced participation and scrutiny, other features of open data.[17] The emerging fields of open governance and open development (see Text Box 1) are also built on similar principles and techniques.

OPEN GOVERNMENT AND OPEN DEVELOPMENT

OPEN GOVERNANCE/GOVERNMENT[18]

Definitions of open governance or open government vary not only across sectors but within them. Definitions focus to varying degrees on the key elements of transparency, citizen participation, and collaboration, among others, depending on the context.

Some illustrative examples of "open government" definitions[19] include:

> *"The general availability of government information is the fundamental basis upon which popular sovereignty and the consent of the governed rest, subject to several important restrictions on this general rule (i.e., to allow for the carrying out of the constitutional powers of the Congress and the President; to protect the personal and property rights of individuals, corporations and associations; to acknowledge administrative complications as to whether to release, to withhold, or to partially release particular types of information under particular conditions; to protect confidentiality of communications internal to government; to acknowledge the difficulty of segregating information when parts of a document should be released and parts withheld)."* [20]
>
> **— *Wallace Parks***
> *"Open Government Principle: Applying the right to know under the Constitution" (1957)*

> *"Open government is defined as a system of transparency (information disclosure; solicit public feedback), public participation (increased opportunities to participate in policymaking), and collaboration (the use of innovative tools, methods, and systems to facilitate cooperation among Government departments, and with nonprofit organizations, businesses, and individuals in the private sector)."*[21]
>
> **— *White House***
> *"Transparency and Open Government: Memorandum for the Heads of Executive Departments and Agencies" (2009)*

> *"Open government involves: Increasing the availability of information about governmental activities; Supporting civic participation; Implementing the highest standards of professional integrity through: Increasing access to new technologies for openness and accountability, information sharing, public participation, and collaboration."*[22]
>
> **— *Open Government Partnership***
> *Open Government Partnership Declaration (2011)*

OPEN DEVELOPMENT[23]

In the wake of open government taking hold as an organizing concept for improving and innovating governance, open development has evolved as a more networked and innovative pathway to improving international aid and development efforts. In a book on the topic, the International Development Research Centre (IDRC) seeks to gain clarity on the contours of the field of open development.[24] Their assessment of the theory and practice involves a number of key elements present in open development work, including:

- The power of human cooperation
- Sharing ideas and knowledge
- The ability to reuse, revise and repurpose content
- Increasing transparency of processes
- Expanding participation
- Collaborative production

Based on the examination of these strands of openness in development efforts from the World Bank, ONE, African Development Bank, and others, the IDRC authors conclude that the central idea behind open development is: "harnessing the increased penetration of information and communications technologies to create new organizational forms that improve the lives of people."[25]

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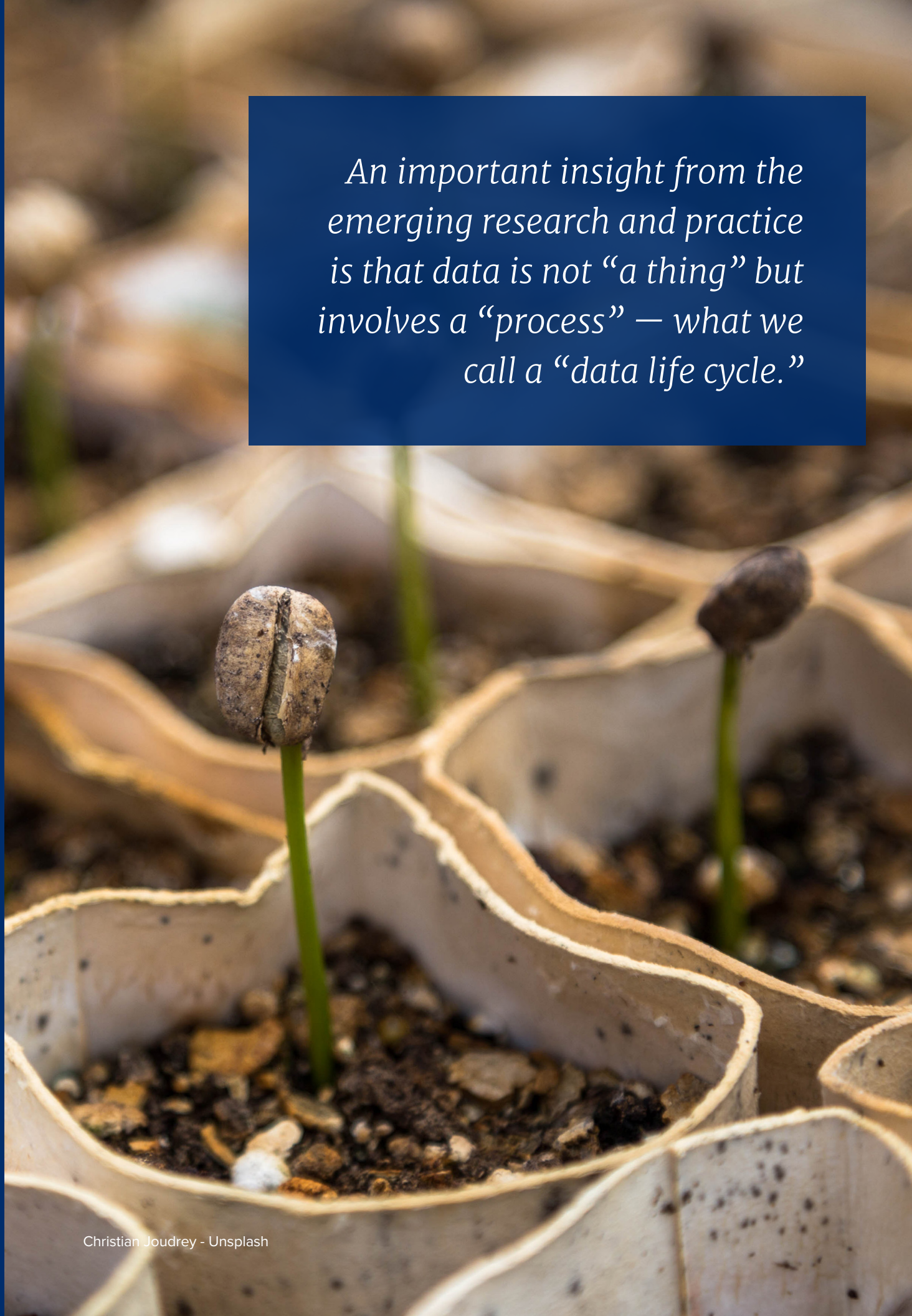
An important insight from the emerging research and practice is that data is not "a thing" but involves a "process" — what we call a "data life cycle."



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DATA LIFE CYCLE

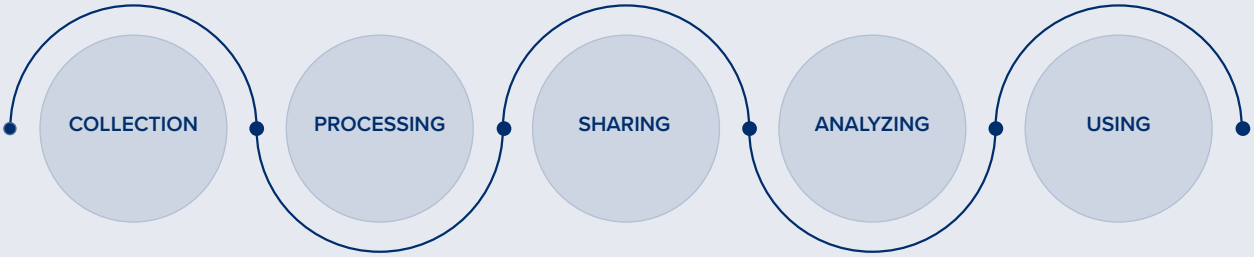

Figure 2: Data Life (The GovLab)

How each stage of the data life cycle is implemented — from collection to processing and sharing; to analysis and using; and back to the start of the cycle again — will determine the value of data and who ultimately benefits. Disparities among those who collect and have access to data or have the capacity to make sense of the data can reinforce existing imbalances in power or influence. This is especially true in a developing economies context where the number of data holders and data scientists is more concentrated, and this smaller group is disproportionately empowered to make meaningful use of data. Within that context, opening datasets is often characterized as a force for democratization — engaging private and civil society actors, and, often indirectly as a result of intermediation, citizens themselves in analyzing and using data.[26] As such, open data provides for unique efficiencies by leveraging civic-minded technologists (government and nongovernment), as well as entrepreneurs, to analyze, disseminate, and/or use data in a new, sometimes profitable way, as discussed more below.

On the other hand, each stage of the data life cycle contains risks. Risks are often the result of technological weaknesses (e.g., security flaws); individual and institutional norms and standards of quality (e.g., weak scientific rigor in analysis); legal confusion or gaps; or misaligned business and other incentives (e.g., companies seeking to push the boundaries of what is socially appropriate). Although there are common elements across these risks, it is useful to examine them by separately considering each stage of the data value cycle.

When risks are not addressed at the initial stages of the value cycle (e.g., when dirty data is not cleaned at the collection stage) they may accumulate and lead to additional risks downstream (e.g., making flawed inferences from the data analysis due to inaccurate data). Therefore, it is important to consider potential risks not just at the points of opening data, but also at the data collection stage and evaluate those risks vis-à-vis the (potential) value of releasing the data. As such, to prevent harm, there may be a legitimate case — especially when there is a clear understanding of the purpose of the use and user — to share certain government datasets with those targeted audiences in a more protected manner to generate necessary insights while limiting the risks. We examine the risks introduced by open data efforts in developing economies in more detail in Part II.

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II. HOW CAN THE IMPACT OF OPEN DATA IN DEVELOPING ECONOMIES BE CAPTURED AND EVIDENCE BE DEVELOPED?

Many studies of open data are concerned with proving a case — either that open data can spur rapid social transformation (the positive case), or that it has a negligible or harmful effect (the negative case). In truth, the evidence is mixed and emergent; the impact of open data is, in fact, far more ambiguous. Rather than just asking *Does open data spur development?* we seek in this paper to also ask, *How and under what conditions can it work?*

To answer this question, we've examined a wide and variable range of attempts to provide evidence to develop a plausible "theory of change" that would explain the role of open data in development. Theories of change are important. A recent report from the United Kingdom's Institute of Development Studies points to "the persistence of poorly articulated theories of change that fail to specify realistic causal pathways at the outset" in relation to transparency initiatives.[27] Weak theories of change can lead to a variety of false assumptions and misconceptions when it comes to understanding how open data works; these, in turn, can lead to missed opportunities, spending inefficiencies, and a general failure to live up to open data's potential.

A review of the literature shows that numerous pathways and theories of change have in fact been proposed. For example, a recent study conducted by IDRC, the World Wide Web Foundation, and the Berkman Klein Center for Internet and Society at Harvard University cites at least thirteen "theories of change," including open data's ability to reduce transaction costs, generate new forms of economic growth and prosperity, generate new revenue models, and disrupt traditional business models.[28] Others point to the social and environmental benefits of open data. For example, Martin Hilbert draws attention to the potential of opening geospatial-, education-, and housing-related information. Based on a review of 180 pieces of literature related to Big and Open Data, he concludes — with caveats we discuss further below — that open data does in fact contain true opportunities for development.[29]

OPEN DATA IN DEVELOPING ECONOMIES LOGIC MODEL

In what follows, we describe a change theory for open data using the Open Data in Developing Economies Logic Model (Figure 3).[30] This model suggests that:

> *Open data (supply), when analyzed and leveraged by both governmental and non-governmental actors (demand), can be used in a variety of ways (actions and outputs), within the parameters established by certain enabling conditions (and disabling factors), to improve government, empower citizens and users, create economic opportunity and/or solve societal problems (impact).*

It is important to reiterate, however, that these positive impacts are always subject to certain local, context-sensitive enabling conditions and disabling factors. While this logic model presents a general outline of how open data can work, Table 1, below, presents a more detailed explanation of how it interacts with various sector-specific opportunities and challenges to create genuine impact on the ground.

The logic model is built around the premise (informed by the case studies and primed for further experimentation and research) that higher impact open data projects are the result of matching the supply to the demand of data actors who can operationalize open data toward specific activities and outputs. These outputs and activities can, in turn, serve a broader and more diverse group of users and objectives.

Having a logic model allows for a more detailed analysis within and across sectors of open data toward providing a number of highly specific lessons about actors and conditions, opportunities and challenges.

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OPEN DATA IN DEVELOPING ECONOMIES LOGIC MODEL

Figure 3. Open Data in Developing Economies Logic Model

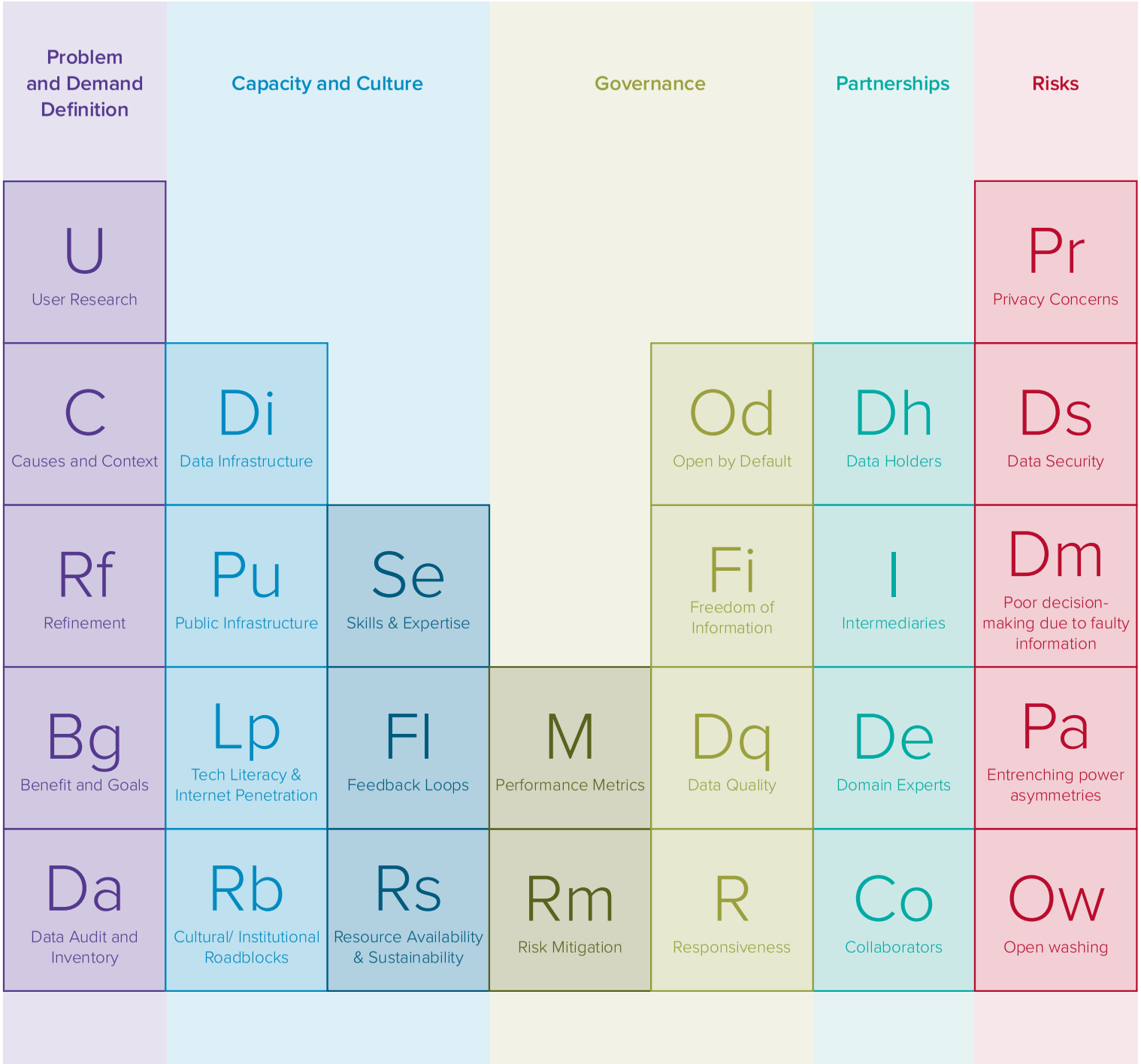
Input (Supply)	Actors (Demand)	Activity	Output	Use/Users	Indicators	Impact
Open Government Data "Open data is publicly available data that can be universally and readily accessed, used and re-distributed free of charge. It is structured for usability and computability." Including, for instance: ▸ GIS Data ▸ Observed Data (e.g., weather) ▸ Financial Data ▸ Administrative Data ▸ Statistical Data ▸ Audit Data	NGOs & Interest Groups Researchers and Academia Journalists and Media Outlets Donor Organizations Private Sector — Entrepreneurs and Corporations Government Officials	Data Analysis (Methods) Presentation (Visualization) Aggregation and Commingling (Mashups) Dissemination — toward, for instance: ▸ Benchmarking ▸ Hotspotting ▸ Comparing services and performance ▸ Resource allocation ▸ Diagnosis and assessment	Decision Trees Maps Apps and Platforms Dashboards Process improvements Data-driven journalism Infographics Searchable databases Policies Advocacy Alerts	Other Government Agencies and Officials Nongovernment Actors including, for instance: ▸ Citizens ▸ Researchers ▸ Entrepreneurs ▸ Corporations ▸ Service providers ▸ NGOs & interest groups ▸ Media outlets ▸ Donor organizations	The outputs of open data have had several real-world effects, which can be assessed according to a number of indicators, for instance: Accountability ▸ Court cases on corruption Improved service delivery: ▸ Increase in citizens receiving services Increased information sharing: ▸ Collaborations between public entities Enhanced decision-making capacity and choice: ▸ Satisfaction among citizens Social mobilization: ▸ Data-driven advocacy efforts Job creation: ▸ Employment in data-driven fields Frugal innovation: ▸ Data-driven startups Economic growth: ▸ Industry-level growth figures Improved situational awareness: ▸ Time saved responding to emerging situations and crises More expertise and knowledge brought to bear: ▸ Number of disciplines engaged in decision-making processes ▸ Targeting interventions and tracking impact: ▸ Assessment of change against baseline indicators	Improving Government ▸ Accountability ▸ Improved service delivery ▸ Increased information sharing Empowering Citizens ▸ Enhanced decision making capacity and choice ▸ Social mobilization Innovation and Creating Economic Opportunity ▸ Job creation ▸ Frugal innovation ▸ Economic growth Solving Public Problems ▸ Improved situational awareness ▸ More expertise and knowledge brought to bear ▸ Targeting interventions and tracking impact

Enabling Conditions and Disabling Factors

- **Problem and Demand Definition:** whether and how the problem to be addressed and/or the demand for open data are clearly defined and understood
- **Capacity and Culture:** whether and how resources, human capital and technological capabilities are sufficiently available and leveraged meaningfully
- **Partnerships:** whether collaboration within and, especially, across sectors using open data exist
- **Risks:** whether and how the risks associated with open data are assessed and mitigated;
- **Governance:** whether and how decisions affecting the use of open data are made in a responsive manner

Table 1. In-Depth Logic Framework

PERIODIC TABLE OF OPEN DATA IMPACT



EXAMINING THE OPEN DATA IN DEVELOPING ECONOMIES LOGIC FRAMEWORK

The logic model presented in Figure 3 above describes the elements in place across the lifespan of an open data initiative, from the initial input or supply of data through its use and impact, with several enabling conditions and disabling factors influencing impact. We explore each of the elements introduced in the table in more detail below, with attention to the types of impact and the enabling conditions and disabling factors that inform the Periodic Table of Open Data Elements.

INPUT (SUPPLY)

A diversity of data types make up the supply side of open data in developing economies and, as the input, plays a key role in determining the ultimate impact. Data types being made available in developing countries range from information about the planet, such as geospatial and weather information, to information about the workings of government itself, like financial and administrative data. Of importance within a developing country context, involves data that is collected and potentially supplied by international (donor) organizations and civil society (often through crowd-sourced means) that may complement the supply of domestic government data. Much of the focus in the early days of open data (in both developed and developing economies) has fallen on improving the supply side of open data, with the Open Data Charter and Open Government Partnership, for example, pushing government data holders to make certain types of data accessible according to a number of principles and in a standardized way.

ACTORS (DEMAND)

As the global open data ecosystem matures, a greater focus is being placed on understanding the demand side of open data — the actors who will make use of the information the governments released. As the supply side of open data continues to improve thanks to international standardization efforts, including the Open Data Charter and advocacy at the national and regional level, the demand side stands to benefit through greater engagement of existing demand-side actors, and the identification of additional stakeholders who could make use of that information. Some of the key yet distinctive segments or constituencies (often with different interests and needs) on the demand side of open data include nongovernmental organizations (NGOs), including not only government watchdog groups but also service providers, researchers and scholars, data-driven journalists, entrepreneurs and businesses, and government officials themselves who benefit from more liquid data that has escaped internal silos.

ACTIVITIES

The activities enabled by access to open data are in many ways only limited by the imagination and skills of the actors on the demand side of the equation. Some of the most common ways that open data is used include data analysis to uncover new insights, presentation and visualization to make the information more comprehensible, aggregation and commingling of multiple datasets to gain a more multi-faceted view of an issue, and eventually dissemination of processed open data toward benchmarking efforts, hotspotting (e.g., data-driven crime or healthcare maps), or informing future resource allocation decision making.

OUTPUT

Like the activities open data enables, the output of processed open data can take any number of forms depending on the problem or opportunity the data is meant to address and the priorities of the actors on the demand side. Although the output of open data initiatives is often some form of data or technology — such as searchable databases, information dashboards or smartphone applications — they can also take the form of evidence-based policies, advocacy, or activism efforts or data-driven journalism pieces.

USE/USERS

The existence of actors on the demand side of open data and users of the open data-driven outputs those actors create complicates the lifespan of open data and makes clear the need for responsiveness and feedback loops on the supply side. In many cases, the types of actors representing the demand side of open data are also present as users of open data outputs — such as NGOs or journalists. The community of user includes a broader swath of the population, however, with individuals and entities that lack any data science capabilities still able to make use of the outputs of open data — whether in the form of smartphone weather applications, data-driven infographics in the newspaper, or government process optimizations.

INDICATORS

In many ways, open data is a double-edged sword. How open data is made accessible to the public ensures that anyone can use open data for any reason. It also means that identifying those usages and capturing their impacts is extremely challenging, especially for resource-strapped governments. To gain some meaningful sense of the impact of open data releases, data holders can seek to develop indicators tied to the problems open datasets stand to address. After the release of open data on the financial dealings of government officials, for instance, an uptick in court cases on corruption could provide a window into open data's impact on accountability. Similarly, the creation of more data-driven startups, increased investment from international donors, or increases in hiring among technology companies that use (or are likely to use) open data can act as indicators of open data's effect on economic development. Especially in developing economies where government resources are often limited, meaningfully capturing the impacts of open data through indicators of success will likely prove essential for maintaining the political will needed for open data efforts to be sustainable.

TYPES OF IMPACT

As reflected in Table 1, our research indicates that open data has four main types of impact, and that each type of impact requires different indicators. Although the four types of impact described below provide a framework of analysis, it is also important to understand that these types of impact can manifest in different ways, and some projects might seek to achieve more than one type of impact. In the discussion below, we point to a diversity of open data initiatives aimed at having a positive effect in one or more of these impact areas, but in some cases, impact remains largely aspirational; in others, impact was negligible, or in fact, negative. Rather than focusing exclusively on gold-standard open data projects with unquestionable and consequential on-the-ground impacts — like the oft-referenced Global Positioning System or opening of weather data in the United States — we examine initiatives across the spectrum of impact to develop a more detailed understanding of the current reality for open data in developing economies, and more importantly, to provide testable premises of how to create an impact based on lessons learned from efforts to date, even some efforts that have not (yet) created major positive impacts.

To be sure, much of the evidence provided below is emergent, and in some cases largely speculative. Collecting and organizing these signals of what is known (and believed) about open data for development, however, provides for a systematic understanding of the current field, and informs more strategic, analytical assessments of open data's impact going forward. So although the evidence here is unquestionably variable — ranging from concrete, clearly demonstrable on-the-ground impacts to largely ideological assertions of impact — they provide a frame for understanding the field and taking the next step toward meaningful impact assessment.

IMPROVING GOVERNANCE

One of the most consistent ways in which open data has an impact on development, across countries and regions, is in *improving governance*. This impact manifests in several ways:

- Greater transparency and citizen involvement can make governments **more accountable** to their citizens.
- A focus on data use and data-driven decision making engendered by the institutional process of opening data (i.e., cleaning and making liquid government datasets) can result in **better and more efficient service delivery.**
- In addition to making data accessible to entities outside of government, open data efforts can **increase information sharing** between departments and agencies within government, improving coordination and knowledge-sharing.

EMERGENT EVIDENCE:

Elections in Burkina Faso: To ensure elections in Burkina Faso were conducted fairly, poll results were made available in real time via an official election website, which tracked candidates leading in each of the provinces. This project, run by the Burkina Open Data Initiative (BODI, http://data.gov.bf/about) with the support of the ODI, sought to promote democracy and trust between Burkina Faso's citizens and elected officials. For a country in transition like Burkina Faso, opening electoral data was seen as an important first step toward establishing longer term political stability and citizen trust in the electoral process, though the number of citizens or organizations who actually accessed and acted upon the data is unclear.[31]

Elections in Indonesia: In a similar initiative, Indonesia's Kawal Pemilu ("guard the election," in Indonesian) was launched in the immediate aftermath of the 2014 presidential elections, as the country was riven by political polarization and the two leading contenders for the presidency traded allegations of vote rigging. A globally dispersed group of technologists, activists, and volunteers came together to create a website that would allow citizens to compare official vote tallies with the original tabulations from polling stations. These tabulations were already made public as part of the Elections General Commission's commitment to openness and transparency. Kawal Pemilu's organizers, however, played a critical role in assembling a team of over 700 volunteers to digitize the often-handwritten forms and make the data more legible and accessible. The site was assembled in a mere two days, with a total budget of just $54. Not only did the site enable citizen participation in monitoring the election results, but Kawal Pemilu's vote tallies also played an important role in court hearings confirming the election winner.[32]

Data Journalism in Kenya: In Kenya, journalists leveraged open data to report on a "freeze" in the dissemination of welfare support to the elderly and disabled. The freeze was traced back to a government failure to build an effective system for distributing such funds and, as a result, a significant amount of public money went missing. Media attention and public pressure that grew out of this open data-driven journalism effort led to an audit of the program and the implementation of reforms.[33]

EMPOWERING CITIZENS

Open data also has a powerful role to play in *empowering citizens*. This role is evident in several ways:

- With more access to information in hand (including information on, for example, health care or education choices), citizens can have **improved decision-making capacity and choice.**
- As a result of increased transparency, open data can act as a **social mobilization** tool when information made available to the public can inform advocacy efforts, including those related to corruption or perceived corruption, consumer advocacy, or health care and other service delivery.

EMERGENT EVIDENCE:

Follow the Money Nigeria: In Nigeria, a consortium of activists, journalists, researchers and NGOs use open data to track and visualize government expenditures. Based on knowledge drawn from open data regarding current spending practices, the group successfully pushed the Nigerian government to allocate $5.3 million to help address a lead poisoning crisis in the village of Bagega that affected thousands of children. Follow the Money Nigeria in fact demonstrates how open data can both improve governance (as a result of enabling better, more evidence-based policy decisions) and empower citizens to have an impact on their communities. [34]

Seeking to Improve Voter Turnout in Kenya with Open Data: Kenya's national Independent Electoral and Boundaries Commission (IEBC) released information about polling center locations on its website in the lead up to Kenya's 2013 general election. The information, however, was difficult to access and reuse. Seizing on the gap between opening government data and citizens' actual ability to use that data, two Code 4 Kenya fellows conducted an experiment in unlocking government data to make it useful to the public. The fellows scraped the released IEBC data and built a simple website where it could be more easily accessed. The result was the initial version of GotToVote! a site that provided citizens with voter registration center information, and also helped them navigate the sometimes complex world of registration procedures. This first version was developed in just 24 hours at minimum cost, garnered over 6,000 site visits in just its first week of existence, and has since been replicated across sub-Saharan Africa.

Social Movements in Brazil: The availability of open data has helped to inform the community organizing and advocacy efforts of several social movements in Brazil. Efforts to fight the use of pesticides latched onto the fact that "each Brazilian citizen is exposed to [5.2 liters] of pesticides every year." Similarly, an effort to fight school closures has rallied around the 24,000 schools that open data shows have been closed over the last 10 years. Efforts to fight violence against women and the consolidation of land ownership are similarly using open

data to aid in their advocacy. There's little causal evidence that these efforts directly created significant policy impact, however, though the resignation of the Minister of Promotion of Racial Equality is credited to open data-driven reporting and advocacy.[35] So although these advocacy efforts demonstrate how open data can empower citizens and advocates through access to important factual information, more work needs to be done (and responsiveness in the public sector must be engendered) to create more direct, tangible impacts.[36]

CREATING OPPORTUNITY

Under the right conditions, open data can help *create economic activity*. If harnessed properly, this is a particularly important form of impact in developing economies. Our case studies indicate that open data can have a positive impact on economic activity in the following ways:

- As the global economy becomes increasingly reliant on data and information, the accessibility of open data can enable **business creation, foreign investment,** and meaningful **job creation.**
- Open data is increasingly seen as a new business asset but, unlike many such assets, it is available free of charge, opening the door to more **frugal innovation** efforts in the private sector.
- More than just an asset to individual businesses or entrepreneurs, many predictive analyses have pointed to open data's potential for creating more systemic and far-reaching **economic growth**, particularly when commingled with proprietary data held by private sector entities.[37]

EMERGENT EVIDENCE:

Market Research in Kenya and Nigeria: Sagaci Research is a market intelligence firm based in Kenya that works across countries in Africa. The firm's strategic knowledge offerings — spanning sectors like consumer goods, agriculture, and telecom — are built from researchers and field surveyors active across Africa and, importantly, open census and national statistical data from the Kenyan and Nigerian governments. According to the Sagaci website, 90 percent of its clients have pursued follow-on work with the firm, demonstrating the value of its open data-driven offerings.[38]

Data Mapping Consultation in India: Excel Geomatics is a private consultancy firm that leverages open data to provide geospatial insights to private and public sector clients. The company's offerings — including ward maps of more than 700 towns and cities and satellite image-enabled population distribution maps — would not be possible without access to data from the Indian census, as well as publicly accessible village and district boundary maps. Importantly, Excel Geomatics uses the Earth Observing System Data and Information

System (EOSDIS) and ASTER database from NASA for its products and services — demonstrating how the opening of data in developed countries often creates impacts far afield.[39]

Open Data to Benefit Tourism in Jamaica: Like much of the Caribbean, the Jamaican economy is strongly dependent on the health of its tourism industry. Influenced by the rise of all-inclusive resorts and a general disincentive for tourists to stray far from a few highly trafficked areas, tourists rarely experience much of Jamaica's unique culture, and the economic benefits of tourism are often concentrated in a few areas. To increase tourism, spread its positive impacts and provide useful skills to citizens, a community mapping project[40] combined open government data with crowdsourced, volunteer-collected mapping data to enable the more participatory development of the tourism sector. Built around open tourism data and the engagement of government agencies, civil society organizations, developers, and an interested group of community mappers, the initiative has created new artifacts aimed at better spreading the economic impacts of the tourism industry in Jamaica, though impact remains primarily aspirational.[41]

SOLVING PUBLIC PROBLEMS

Finally, open data's impact is evident in the contribution it makes to *solving public problems*. Open data can help address complex problems in the following ways:

- Especially in crisis situations where geospatial information can prove essential,[42] open data can play a role in **improving situational awareness**.
- In some developing countries, government is the primary data holder and data user, limiting the number of people capable of creating value with data. The accessibility of open data can help to bring a **wider range of expertise and knowledge** to bear on public problems.
- In many cases the result of improved situational awareness and more expertise brought to bear, open data can play an important role in **targeting interventions** and meaningfully **tracking impact**.

EMERGENT EVIDENCE:

Stopping Deforestation in Brazil and Indonesia: To monitor deforestation in Brazil and Indonesia, Global Forest Watch consolidates satellite imagery datasets to monitor global deforestation in real time. Monitoring on this scale has produced several observable positive effects. For instance, data from the project has been used in legal proceedings related to illegal logging. Although causation cannot be proved directly, deforestation has declined in both countries — deforestation in Indonesia is at its lowest levels in a decade and has declined by 18 percent in Brazil.[43] It is important to note that prior to this project, deforestation levels were consistently rising in both nations. The Indonesian government also uses GFW to monitor forest and peat fires and target response.[44] In Brazil, firefighters

have reduced their response time to forest fires from 36 hours to 4 hours. This project is a forceful demonstration that intelligent use of open data can be used for successful advocacy — and could even provide additional benefits that may not have been anticipated.

Fighting Ebola in Sierra Leone: In the parts of West Africa affected by the Ebola epidemic, roads, village names. and villages were missing on many online maps. OpenStreetMap (OSM), a free, crowdsourced mapping tool provided critical mapping information to Sierra Leone's National Ebola Response Centre (NERC), the United Nation's Humanitarian Data Exchange, and to the Ebola GeoNode to assist them in coordinating public health strategies in response to the epidemic. The OSM data was then often mashed up with open data from affected governments and international organizations. Although the direct impact of open data in the Ebola response was difficult to empirically measure, those working on the ground during the response made clear that providing missing data in open formats played an important role in fighting a complex epidemic and coordinating relief efforts of those working in a chaotic, fast-developing context.[45]

Targeting Disaster Risk Funding in the Philippines: The Philippines was one of the eight founding members of the Open Government Partnership launched in 2011, endorsing an Open Government Declaration to commit to open data. As part of its commitment, in 2014 the Philippine government launched data.gov.ph, which publishes data from government agencies for the public to access. Though some federal agencies have been hesitant to disclose their data in an open and accessible way, at the local government level the open data initiative is making more headway. The disclosure of spending data in Bohol province, for example, allowed civil society groups to notice that insufficient funds were allocated to disaster risk reduction projects. As a result, organizations are now drafting new disaster-reduction proposals to lobby the government to provide more support to this area.[46]

PakReport Crisis Mapping: In the wake of the worst flooding in Pakistan in decades, several crisis mapping organizations (led by PakReport) teamed with relief organizations to map affected areas in real time. This project was a piece of a broader trend toward crisis mapping, particularly after natural disasters. Collaboration of this kind allows aid organizations to survey areas that may be difficult to landscape because of the disaster and correctly understand where needs are greatest and what kind of assistance populations across the affected area require. The efforts of the PakReport team demonstrate the complicated nature of international disaster relief and the need for comprehensive and proactive data responsibility assessments. Pointing to the risks and unintended consequences of open data, PakReport was forced to restrict access to its crowdsourced maps, which were intended to be open and freely accessible, after the Taliban threatened to attack foreign aid workers in the country, whose presence they deemed "unacceptable."[47]

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ENABLING CONDITIONS AND DISABLING FACTORS

Based on the existing literature (see Appendix D) and case studies, we have developed a Periodic Table of Open Data Elements (Table 2 above) detailing the enabling conditions and disabling factors that often determine the impact of open data initiatives. Although the importance of local variation and context is, of course, paramount, current research and practice shows that the elements included in five central issue categories — Problem and Demand Definition, Capacity and Culture, Partnerships, Risks, Governance — are likely to either enable or disrupt the success of open data projects when replicated across countries.

As discussed above, there is a large variability as it relates to evidence of open data's impact, so we provide these enabling conditions and disabling factors not as a concrete, certain drivers of success or failure, but as an aggregated set of premises to be tested as the field of practice and research of open data in developing economies continues to expand and mature. We examine these enabling conditions and disabling factors in more detail below.

PROBLEM AND DEMAND DEFINITION

Particularly in developing economies, where resources to put toward data release or data use can be in short supply, a clear, detailed understanding of the problem to be addressed by open data can help to ensure that efforts are targeted and optimized. Some of the most effective open data projects examined here are laser-focused on a specific user group (e.g., smallholder farmers in Colombia or Ghana), or identified gap (e.g., the lack of power quality in the Indian energy sector). Clearly defining the problem can also aid in the development of metrics of success and a strategy for monitoring progress against a well-defined baseline. Many of the initiatives studied as part of this project lacked such a monitoring strategy, making assessments of impact, evidence-driven iteration, and the demonstration of return on investment more challenging.

U
User Research

Open data initiatives tend to be more successful and avoid the notion of, "if you build it, will they come," when they are clearly optimized for an intended audience or user base from the start. The upfront identification, mapping and understanding of relevant constituencies, and a similar examination of their needs can enable more targeted open data-driven interventions.

C
Causes and Context

In many open data initiatives, and in governance innovation efforts more generally, practitioners can find themselves addressing symptoms rather than the root causes of problems. Open data projects, such as the effort to predict dengue outbreaks in Paraguay, tend to be more successful when they seek to address underlying problems (mosquito breeding and transmission) rather than the symptoms of those problems (high levels of dengue fever).

Rf
Refinement

To move from a well-understood problem area, to a granular, actionable, and quantifiable path forward, successful practitioners often look to refine their understanding of the problem to be addressed by seeking to understand, for instance, *why* the problem exists in its current form, what contributing factors could be at play, what potential knock-on effects of addressing the problem might be, and why the problem has not yet been solved by some other interested party.

Bg
Benefit and Goals

Open data projects often fail to build an audience or continue to evolve and expand successfully over time if they do not successfully define the intended benefits of the open data use and set clear target goals. These deficiencies often can create difficulty in the development of metrics and indicators — important drivers of iteration and impact.

Many of the projects studied, including notably Kenya's GotToVote! project did not have a clear baseline against which to measure the success of the project. Without an understanding of the current baseline, measuring progress toward identified goals and demonstrating whether and how open data efforts actually benefited the public remains a challenge.

Da
Data Audit and Inventory

Once the problem and value proposition are in place, practitioners are able to explore the availability of datasets**,** both in the form of open government data, and from other potentially useful and relevant data sources, like NGOs, the private sector, or crowdsourcing efforts. A clear problem definition can help to uncover which data sources could add value and inform strategies for collecting or accessing that data. Colombia's Aclímate Colombia, for instance, identified the types of data it needed for its agriculture algorithms and engaged the semi-public industry groups that had it. The Prayas Energy Group in India, on the other hand, found that no one collected or stored the type of energy usage information it needed for its power quality monitoring efforts, so it launched its own (open) data collection effort across 18 Indian states.

PARTNERSHIPS

In many high-impact open data projects, partnerships within and especially across sectors play a key role in enabling success. Whether creating touchpoints with citizens through partnerships with civil society, informing the public through media partnerships, or filling important data gaps through partnerships with private sector entities, open data suppliers and users often improve outcomes through collaboration.

Dh
Data Holders

Although open data is meant to provide value to data users without any direct engagement with data holders necessary, partnering with entities on the supply side (including government) can help to fill data gaps and enable higher impact data use.

Aclímate Colombia is a strong example of the potential of such partnerships. The initiative, aimed at providing farmers with a better ability to plant crops in a way that is resilient to changes in climate, would not be possible without collaboration between the driver of the initiative (a civil society organization), key data holders (government ministries and agencies), and a second group of key data holders (private and semi-private crop growers' associations). GotToVote! in Kenya, on the other hand, did not establish such cross-sector partnerships, and its long-term sustainability is now in question.

I
Intermediaries

In many developing economies, as mentioned above, Internet penetration and, especially, data literacy are low among the citizenry. The presence of intermediaries — including journalists and others with relevant skills — can help to determine whether or not the available open data-driven outputs reach a community of users, and the intended impact is achieved.[49] The continued advancement of open data intermediaries can be seen as a key area of capacity building in developing economies.

To encourage the use of Code for South Africa's MPRApp, doctors and pharmacists played an important intermediation role with citizens. These trusted advisors — with nothing to gain from helping patients spend less money on their prescriptions — helped to alert citizens to the database and the potential for identifying much cheaper generic drugs to treat their ailments.

In addition, the open data-driven offerings of Open Development Cambodia are often presented on the initiative's website in a comprehensible manner (similar to data-driven Wikipedia articles on topics of public concern, like forest cover or development aid spending), but reach a much wider audience when taken up by journalists in the country and abroad in reporting on conditions in the country.

Both of Tanzania's open education dashboards, on the other hand, failed to attract a regular user base, likely as a result of a failure to engage consistently with intermediaries that could make the sites' offerings useful to an intended audience with low digital literacy and access.

De
Domain Experts

In many cases, demand-side open data actors' expertise lies in technology or data science rather than the problem areas they seek to address through the use of open data. Tapping into the knowledge of stakeholders with relevant sector-specific expertise can improve efforts to optimize and target open data efforts based on a true understanding of needs, opportunities, and barriers. Nepali NGOs and businesses using open government data and crowdsourced data during the response to a major earthquake in the country, for instance, engaged with on-the-ground experts in crisis response who came to Nepal from around the world to help target its offerings.

Co
Collaborators

Open data practitioners can extend their capacity by collaborating with like-minded organizations, institutions, or individuals, including foreign actors. Ghana's Esoko agricultural information service, for example, is part of the Global Open Data for Agriculture and Nutrition (GODAN) network, enabling the company to tap into the knowledge of similar organizations from around the world seeking to leverage open agriculture data for business development and/or public benefit.

RISKS

The release and use of open data in developing economies are not without risks. An upfront mapping and consideration of risks associated with intended uses of open data can allow practitioners to design programs from the outset in a way that is well-positioned to overcome or mitigate those risks. The risks listed here, however, should not be considered arguments against using open data in development. Rather, they are reasons for taking a more fine-grained approach that pays close attention to the empirical evidence, sifting out what works and what does not, and identifying conditions for scaling and replication.

Pr
Privacy Concerns

Privacy concerns probably rank among the most commonly cited worries over opening up data. Especially in conflict-stricken regions, individuals' anonymity can be of life-or-death importance. Potential privacy harms can arise even from the release of ostensibly anonymized personally identifiable information (PII).[50] Although the vast majority of open data efforts seek to anonymize or otherwise limit the release of PII, it is important to recognize that a lack of sophistication in anonymization or aggregation efforts can result in the inadvertent release of sensitive information.[51] In addition, in some instances information that itself poses no privacy concerns can be combined with other openly available datasets; the aggregated and linked information can lead to unexpected disclosure of personal data, such as bringing together open data on political activities with separately accessible information on a person's location or place of work, for example.[52]

Ds
Data Security

Because much government data contains sensitive information regarding individuals, industries, and national security, opening that data often leads to quite reasonable questions about data security. Cybersecurity remains a challenge across the world, and perhaps especially so in developing countries, which may lack the technical expertise to adequately protect information from sophisticated hackers and other intrusions.[53] At the same time, though security concerns are very real and important, they must be balanced against the opportunity cost or risk of not sharing data; often, government decision makers can lean on tenuous security concerns to justify keeping data closed and restricting access, potentially limiting the solution space.

Dm
Poor decision-making due to faulty information

Whether related to humanitarian efforts, crisis relief, or the livelihoods of vulnerable populations, data-driven efforts in developing economies can be literally life-or-death affairs. Given the many challenges and obstacles involved in open data projects, it is important to recognize the risks inherent in basing such life-and-death decisions on information that could be incomplete, out-of-date or otherwise faulty. The broader point is this: insights generated from data are only as good — and their impacts only as positive — as the quality of the underlying data.[54]

Pa
Entrenching power asymmetries

Although data can be empowering, it can also consolidate or reinforce existing privileges and authority inherent in societies. This problem is closely linked (though not restricted) to digital divide challenges; when only the elite of a society have access to data and/or data science capabilities, releasing data is likely to disproportionally benefit that elite.[55] We found numerous examples,[56] and they are important reminders that open data projects need to work hard to ensure that their social and economic benefits are widely, and evenly, distributed.

Ow
Open washing

The term *"open washing"* has taken hold in practitioner circles over recent years describing the risk that governments may seek to leverage the enthusiasm for open data to avoid more difficult and potentially transformative openness and transparency efforts.[57] The Extractives Industries Transparency Initiative, for instance, is a laudable effort to push for more energy-related openness around the world, which has had demonstrable impacts on accountability. There is a growing belief, however, that a subset of still largely closed governments is joining the initiative only "in order to increase their international reputation and bolster their access to foreign aid."[58]

CAPACITY AND CULTURE

The lack of available resources, insufficient human capital and immature technological capabilities can create major challenges to achieving meaningful impact with open data projects. These challenges can exist both within a country's open data ecosystem — that is, the capacity of government, civil society, tech community, and the general public — as well as within the actors on the demand side using open data toward certain objectives and the donor organizations funding them.

OPEN DATA ECOSYSTEM ELEMENTS

Di
Data Infrastructure

On the supply side of open data the lack of a strong data infrastructure — that is, hardware and software platforms to make data consistently accessible and machine-readable in a timely manner — often creates major challenges to positive impact.

Burundi's OpenRBF platform is an example of working around issues related to data infrastructure. Burundi provided access to data on its results-based financing efforts around healthcare through the OpenRBF platform, a digital infrastructure for collecting and publishing such data. The existence of an "out-of-the-box" tool for making results-based funding (RBF) data public in reusable formats catalyzed the widespread opening of RBF data across many developing countries in Africa.

Pu
Public Infrastructure

Similar to the ICT4D environment, much of the literature and practice[48] of open data in developing economies points to the importance of a strong public infrastructure — human capital (including data science and statistical knowledge), public services (including education and libraries), and civil society — to ensure that data is collected, cleaned, and released in a usable manner and that updates and feedback are seamlessly incorporated into open datasets. Supply side efforts to leverage these public infrastructures can increase the demand for open data and establish touchpoints with users.

An active ecosystem of data users and international open mapping platforms and individuals helped to ensure that Nepal's open data-driven crisis response efforts could be quickly developed and put into practice. The challenges experienced by Ghana's Esoko platform as a result of unreliable electricity access in the country, on the other hand, shows the many ways that public infrastructure can affect the success of open data projects.

Lp
Tech Literacy & Internet Penetration

Even as access to the Internet continues to expand across the developing world, especially through smartphones and other portable devices, many open data projects are being launched into communities that suffer from low Internet penetration and a persistent digital divide. Several of the initiatives studied struggled to achieve their transformative potential, particularly when practitioners failed to engage intermediaries or civil society groups capable of reaching unconnected audiences.

Stakeholders involved in South Africa's Medicine Price Registry Application (MPRApp) and Tanzania's open education dashboards pointed to low Internet penetration rates, and the related challenge of low tech literacy, as major barriers they confronted to achieving greater positive impacts.

Rb
Cultural/Institutional Roadblocks

As is often the case in developed countries, too, cultural and institutional roadblocks can limit the impact of open data. These roadblocks can manifest in the form of an institutional culture that remains skeptical of openness, or the absence of well-trained individuals and professionals capable of recognizing and acting on the potential of open data (readiness) — beyond the prevalence of engaging volunteers in the development of open data initiatives. In all cases, a more concerted culture- and capacity-building effort is often necessary to create an impact.

In Burundi, for instance, efforts to create transparency and accountability around its results-based financing efforts were slowed and complicated by a lack of readiness for technology-enabled openness within key institutions. Jamaica's open data tourism efforts relied on the readiness of outside volunteers to supplement open data through crowdsourcing — with the impact of the project dependent on their capacity to collect data and information in a strategic, usable manner.

OPEN DATA USER/DONOR ELEMENTS

Se
Skills & Expertise

Especially for more technical uses of open data — such as sophisticated data analytics — actors on the demand side of open data need to possess certain skills and expertise. Employees at CIAT, the organization behind Aclímate Colombia, for instance, possess high-level data science capabilities that enabled them to leverage open data to create sophisticated algorithmic tools to inform agricultural decision making. Other projects, like crowdsourcing efforts from Jamaica and Nepal, relied on the skills of a few important institutional actors on the demand side and the less-technical efforts of volunteer data collectors.

Fl
Feedback Loops

Open data initiatives tend to be less successful when they do not create mechanisms for users and beneficiaries to provide input to demand-side practitioners. Tanzania's open education dashboards are a notable example. The platforms were launched into an environment with low Internet penetration and digital literacy, with seemingly little opportunity for the intended users and beneficiaries of the tools, like parents or education advocates, to suggest ways to make the platforms more usable (and useful) for the community.

Rs
Resource Availability & Sustainability

The availability of funding and resources are a key variable of success on both the supply and demand sides of open data. Focusing on the demand side, although many open data projects can be stood up quickly on a tight budget (such as Kenya's GotToVote! an initial prototype of which was created for only $500), sometimes with a very small team (Paraguay's dengue prediction efforts were championed by researcher Juan Pane and a small team under his direction), establishing sustainability and scaling use often requires more sustained funding and/or well-defined business models. This was the dynamic at work for example in South Africa, where the MPRApp relied almost entirely on the time and effort of a single person. Likewise, in Uganda, CIPESA, the developers of the iParticipate open health data and citizen engagement effort, struggled to proactively elevate health service delivery concerns to relevant government officials because of funding issues affecting both data collection and outreach efforts.

The agriculture information tool Esoko, on the other hand, has managed to take hold in Ghana in large part due to its for-profit, largely business to business (B2B) model, as well as significant investments from foundations and international organizations.

GOVERNANCE

A diversity of governing decisions affect the use and impact of open data efforts. Issues of governance exist at both the ecosystem level — especially related to standards and policies of data release — and on the demand side, with questions of risk mitigation and impact assessment leading the way.

OPEN DATA ECOSYSTEM ELEMENTS

Od
Open by Default

Given the level of government resource allocation and time investment required to implement strong open data initiatives, high-level political buy-in and codified open data policies (reflecting the International Open Data Charter principles)[59] are needed to provide the incentives and flexibility to government officials to meaningfully advance open data goals.

The ESMI effort in India, for example, is an industry- and NGO-driven effort to create and open useful data on power quality in the country. This effort, which has had relatively little discernible impact to date, is only necessary because of the lack of energy data being opened by government — an issue that could be resolved with a commitment to openness by default and other internationally accepted principles.

Fi
Freedom of Information

Clear policies pushing forward access to information and data can act as important drivers for open data initiatives. Without explicit policy backing, the sustainability of open data efforts can be called into question, and access to necessary data can dry up at any time. The existence of Freedom of Information policies can also provide means for accessing relevant information, though often at a much slower pace than open data.

A key enabler for the MPRApp open data initiative, for example, was South Africa's legislative framework that promotes and enacts transparency in medicine pricing. Such a framework compels the Department of Health to collect and publish data on medicine prices in South Africa, ensuring that the supply side of the MPRApp will continue to be made accessible, allowing Code for South Africa to focus on improving the tool and getting it into the hands of its intended users.

Dq
Data Quality

A widely prevalent challenge to positive impact arises from poor data quality. Data quality is an issue in developed countries, but often presents even greater barriers to success in developing countries. Quality issues can manifest in a number of ways, like inaccurate information, a lack of completeness in official datasets, out-of-date data, or otherwise corrupted datasets.

Aclímate Colombia, for example, experienced challenges gaining access to the most complete and up-to-date information sets for its agriculture tools, slowing their development. Open Development Cambodia's efforts are consistently challenged by not only strong restrictions in terms redistribution, reproduction, and reuse on some datasets, but also by the inconsistency and unpredictability of when updates to important official datasets occur.

In South Africa, the MPRApp was hurt by a lack of interoperability; that is, open data was not made available in standards that allowed for aggregation and manipulation. Likewise, Kenya's GotToVote! experienced major challenges when one of its central data sources crashed unexpectedly, rendering the platform temporarily unusable.

R
Responsiveness

Just as open data is unlikely to create a major impact without demand-side actors to act upon released data, a lack of responsiveness, often characterized by a lack of commitment to take up data-driven insights within governing institutions, can limit the impact of open data. Often, governments succumb to the temptation to open wash data, nominally opening it up but failing to create feedback loops to ensure that users are actually using the data or that data is being released to meet a genuine demand.

In Jamaica, for example, an interactive community mapping project is supplementing open datasets with a crowdsourced effort to improve tourism in the country; the project's clear potential has not yielded major impacts yet in part because tourism authorities have not yet acted on the generated insights. The researchers who used open data to predict dengue fever transmission in Paraguay also experienced ongoing challenges wresting the most useful data for their algorithms from government data holders; there has been little indication that their insights will be meaningfully taken up by institutional authorities.

OPEN DATA USER/DONOR AGENCY ELEMENTS

M
Performance Metrics

Open data projects are better positioned for success when practitioners develop and monitor metrics of impact to inform management and iteration.

The vast majority of the open data initiatives studied in this series lacked clearly defined performance metrics. Not only does this create major challenges for iterating upon early efforts, it calls the sustainability of these interventions into question, with a demonstration of success and impact a likely requirement for continued funding and investment.

Rm
Risk Mitigation

In some cases, open data projects can be advanced despite some level of risk. In such cases, practitioners must ensure that projects that deal in information that is potentially personally identifiable (including anonymized data) have outlined and implemented a clear, upfront strategy for addressing risks created by open data use.

Many of the projects studied in this series dealt in potentially sensitive information—e.g., health, energy consumption, political, and education data. Although each project took steps to ensure that no personally identifiable information was released to the public, all would benefit from a clearly defined—and, preferably, openly available—risk mitigation strategy to ensure that no harms inadvertently fall on data subjects.

THE CHALLENGE OF SCALING AND REPLICATION

Much of this paper, including the above, seeks to identify cross-cutting lessons for open data projects — either in the form of opportunities or challenges. As noted, however, it is important to keep in mind the diversity that exists within the broad category of "developing economies." Differences in culture, economic, and political environments, as well as many other variables, can have a profound effect on the success or otherwise of open data projects.

In many ways, this is another challenge facing stakeholders — and perhaps the most intractable: the difficulty of finding an appropriate balance between universal lessons and certain, locally embedded conditions, when seeking to ***scale and replicate open data projects***. The preceding discussion and the sector-specific examples detailed in Section III do suggest that certain enabling (and disabling) conditions have wide applicability — e.g., the need to include intermediaries and civil society groups,[60] or the paramount importance of capacity and resources.

Perhaps the most critical element for scaling and replication found in the Periodic Table is **Metrics**: the need for open data projects should be evidence based, with clearly defined metrics and standards to evaluate performance. Only with those metrics in place can the applicability or appropriateness of lessons or principles be determined — and only then can the success or failure of projects be established. When making any funding or design decisions, it is essential to take a fine-grained approach that pays close attention to the empirical evidence, sifting out what works and what does not. That is a key goal of the 12 case studies that accompany this landscaping paper; we have tried to build a ground-up, highly empirical picture of open data projects in the developing world.


EL TEMPLE DE LA SAGRADA FAMILIA
MANUELA LLANOS
MI AMIGO FRANZ LISZT
LA CANASTA ALEGRE
Jaimet

III. THE REALIZED AND INTENDED IMPACTS OF OPEN DATA IN DEVELOPING ECONOMIES ACROSS SECTORS

The preceding section has described a logic framework that examines the different components that determine how open data could create an impact. It identifies both enabling and disabling factors for open data initiatives that seek to create four different types of impacts, and expands on them in a practitioner-focused Periodic Table of Open Data Elements. This in effect allows us to create more particular or fine-grained theories of change for each sector and area of impact. In this section, we consider the emerging (and again, variable) evidence of open data's impact on specific sectors that are relevant to the development context. We focus on six sectors: Health, Humanitarian Aid, Agriculture and Nutrition, Poverty Alleviation and Livelihoods, Energy, and Education.

For each sector, we describe illustrative examples of open data's use in developing economies. The cases described here are provided to offer a glimpse into the current field of practice. Some sectors have seen more notable (and novel) applications of open data than others, and some of the examples described here have had little impact to date, or represent instructive failures. But even these lower impact initiatives can aid in identifying testable premises to guide future practice and experimentation. Considered together, these over-arching and sector-specific theories of change build a more complete and detailed matrix of how and under what conditions open data impacts development, providing a set of hypotheses for further research and experimentation.

Phad Pichetbovornkul - Unsplash

HEALTH

Dominik Martin - Unsplash

Improving Governance

The health sector is a major recipient of public funds and international aid, particularly in developing countries.[91] Increasing the transparency of this large area of government expenditure in turn increases accountability, helping ensure resources efficiently and adequately target public health needs.

Empowering Citizens

Accessing quality-of-care information for different health care providers can bolster citizens' ability to make informed choices regarding their service providers.[92] Data on corruption or malpractice in the health care system can particularly enable evidence-based advocacy efforts for patients.

Innovation & Creating Opportunity

As the health sector becomes increasingly data-driven, open data can help spur job creation and the establishment of new service models as a result of both making more information available on the supply side, and using newly accessible health data on the demand side. Though concerns regarding the potential for technology and automation to negatively impact employment also exist.

Solving Public Problems

Especially in the wake of health crises (such as the Ebola outbreak in West Africa or mosquito-borne epidemics in India, for example[93]), access to data across institutions on the availability and location of health resources and on emergent health outcomes can play an important role in addressing major epidemics or ingrained public health concerns.

EXAMPLES

PREDICTING DENGUE OUTBREAKS IN PARAGUAY WITH OPEN DATA

DESCRIPTION

Since 2009, dengue fever has been endemic in Paraguay. Recognizing the clear problem at hand, and the lack of a strong system for communicating dengue-related dangers to the public, the National Health Surveillance Department of Paraguay opened data related to dengue morbidity. Leveraging this data, researchers created an early warning system that can detect outbreaks of dengue fever a week in advance. The data-driven model can predict dengue outbreaks at the city-level in every city in Paraguay. Importantly, the system can be deployed in any region as long as data on morbidity, climate, and water are available.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open health, climate, and water data

ACTORS
Researchers and academia

ACTIVITY
Data analysis

OUTPUT
Process improvements, alerts

USERS
Government officials, researchers

INDICATORS
Accuracy of data-driven predictions

INTENDED IMPACT
Solving public problems

CODE FOR SOUTH AFRICA CHEAPER MEDICINES FOR CONSUMERS

DESCRIPTION

In 2014, Code for South Africa, a South Africa-based nonprofit organization active in the open data space, took a little known dataset from the national Department of Health website and created the Medicine Price Registry Application (MPRApp), an online tool allowing patients (and their doctors) to make sure that they aren't being overcharged by their pharmacies. With no marketing or promotions to speak of, MPRApp has had an impact on the lives of a few South Africans; with a more sustainable model and increased awareness of MPRApp, particularly among trusted intermediaries in the health sector, it could provide more patients access to cheaper medicines.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open medicine data

ACTORS
NGO

ACTIVITY
Dissemination

OUTPUT
Searchable database

USERS
Citizens, health service providers

INDICATORS
Money saved by individuals

INTENDED IMPACT
Empowering citizens

OPEN HEALTH DATA IN UGANDA

DESCRIPTION

In Uganda, open data initiatives are being used in an attempt to improve health outcomes and revolutionize a health care industry marred by staff shortages, lack of resources and corruption. The Kampala-based organization CIPESA has collaborated with a local media organization, Numec, to create the iParticipate project (http://cipesa.org/tag/iparticipate/), which analyzes open government data, and trains citizens and intermediaries to use that data toward empowering citizens to play a bigger role in health governance. Similarly, the Women of Uganda Network (http://wougnet.org), which trains women to use information technology, created an online platform to collect and document information relating to poor health care services. Both these initiatives allow citizens to scrutinize and lobby the public health care sector, aiming to improve its efficiency and ensure that services respond to the needs of citizens in a robust manner.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open health data

ACTORS
NGO, media

ACTIVITY
Aggregation and commingling, dissemination

OUTPUT
Apps and platforms, dashboards

USERS
Citizens

INDICATORS
Improved health service delivery, increased public participation

INTENDED IMPACT
Empowering citizens

OPEN HEALTH DATA IN NAMIBIA

DESCRIPTION

An effort by the government of Namibia to eradicate malaria in the country was bolstered by the use of satellite and cell phone data. Researchers were able to draw “maps of environmental factors like vegetation density, population, and rainfall that affect mosquito and parasite populations and the likelihood of transmission” and identify areas where citizens were at high-risk.[64] Cell phone data provided by Namibia’s largest telecommunications provider assisted researchers to track human movement — and thus the spread of malaria. As a result, the Ministry of Health distributed 1.2 million bed nets to the communities that needed them most.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open health and climate data, private data

ACTORS
Researchers and academia

ACTIVITY
Aggregation and commingling, dissemination

OUTPUT
Maps

USERS
Government officials

INDICATORS
Distribution of mosquito nets

INTENDED IMPACT
Solving public problems

OPEN RESULTS AND PERFORMANCE BASED FINANCING

DESCRIPTION

As part of efforts to improve health outcomes and health system functioning, Burundi was one of the first African countries to introduce RBF. RBF is an instrument that links development financing with pre-determined results. Payment is made only when the agreed-upon results are shown to have been achieved. Open RBF — a platform for opening data related to RBF initiatives — was first delivered in Burundi in response to the Burundian Ministry of Health's efforts to improve health care functioning at the national level and strengthen accountability mechanisms. By opening RBF data, it was believed that increased accessibility and scrutiny of the data could lead to improvements in data quality and engender more accountable data practices. Early returns appear to be positive — Ministry of Health staffers played a role in pushing their peers toward making information on results accessible, for example — though not transformational, and Open RBF engaged in a longer term partnership with the government. Open RBF was concurrently applied to the education and AIDS awareness programs in Burundi; as another sign of impact and scalability, since its launch in Burundi, Open RBF has scaled across 15 countries.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open results-based financing data

ACTORS
NGOs, government officials

ACTIVITY
Dissemination

OUTPUT
Process improvements, searchable databases

USERS
NGOs, government officials

INDICATORS
Decreased instances of corruption

INTENDED IMPACT
Improving Governance

OPEN DATA AND OPEN CONTRACTING FOR NIGERIAN HEALTH CARE CENTRES

DESCRIPTION

In Nigeria, primary health care centers (PHCs) are often located far away from the people who need them most — namely the greater than 50 percent of Nigerians living in poverty. As a result of open data and open contracting efforts, the platform Budeshi enables citizens and watchdogs to actively monitor and unearth financial discrepancies and inefficiencies in the construction of badly needed PHCs around the country. In addition to increasing the transparency of these health care providers, Budeshi positions itself as an advocacy tool, aiming to push the Nigerian government to make a fuller-scale commitment to open contracting principles.[65]

LOGIC FRAMEWORK COMPONENTS

INPUT
Open budget and contracting data

ACTORS
NGO

ACTIVITY
Dissemination

OUTPUT
Apps and platforms, dashboards

USERS
Citizens, NGOs and interest groups

INDICATORS
Decreased instances of corruption

INTENDED IMPACT
Improving governance

HUMANITARIAN AID

Empowering Citizens

When funneled through institutional bureaucracies, humanitarian aid can often overlook the micro-level needs of citizens and their communities. By opening aid allocation data to the public, citizens can provide valuable feedback to governments on how aid is being used, and become active co-partners, rather than mere recipients, of the aid industry.[66]

Innovation & Creating Opportunity

In a field commonly disabled by inaccurate data, where guess-work is rife,[67] open data in humanitarian aid allows NGOs and other civil society organizations to create innovative strategies based on new and accurate information, for example, to help communities in conflict areas or recovering from natural disasters.

Solving Public Problems

Open data initiatives, when built on high-quality, accurate data, can help organizations better identify where and how to invest humanitarian aid to most effectively solve social problems, allowing governments and humanitarian actors to better coordinate relief efforts[68] (for example, through the Humanitarian Data Exchange[69]) and identify sectors that most urgently require humanitarian assistance.

Improving Governance

The misuse of international aid has a long history, with money targeted for specific development efforts failing to be put to use in the expected way. For developing countries that receive a significant amount of aid funding from international organizations, tracking how that money is being used can help root out corruption and catalyze better spending practices in government.

Madi Robson - Unsplash

EXAMPLES

OPEN DEVELOPMENT DATA IN CAMBODIA

DESCRIPTION

Developed by the East-West Management Institute, and part of the broader Open Development Initiative, Open Development Cambodia (ODC) seeks to improve public awareness and information-sharing around development data. ODC uses data aggregated from a diversity of governmental and nongovernmental sources to provide visualizations, mapss and other data-driven products and tools to provide the public sector, private sector, civil society, data-driven journalists, and the general public with a view into the workings and impacts of development efforts, with news reports drawn from its information offerings representing its most apparent benefit to date.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open government data and open NGO data

ACTORS
Researchers, NGOs

ACTIVITY
Data analysis, presentation, aggregation and commingling, dissemination

OUTPUT
Infographics, maps, apps, and platforms

USERS
Government officials, citizens, researchers, NGOs, media

INDICATORS
Decreased instances of corruption

INTENDED IMPACT
Improving governance

AidData IN AFRICA

DESCRIPTION

The open data initiative AidData (http://aiddata.org) tracks international development funding and can be used by developing countries to track and scrutinize their government's foreign aid spending. The project is housed at the College of William & Mary in Virginia; its database has already revealed that China appears to provide more foreign aid to African countries that support their vote in the United Nations General Assembly.[70] Information made available through AidData has also allowed journalists in Africa to chart levels of foreign investment to their countries, owing to the discovery that China has become Tanzania's single largest trading partner, and that Chinese firms receive the lion's share of Tanzanian engineering contracts.[71] The project makes clear that access to aid data can transform the way aid is targeted, and provides citizens and watchdogs with information needed to monitor and give feedback on development projects in their communities.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open development funding data

ACTORS
NGOs

ACTIVITY
Dissemination

OUTPUT
Searchable databases

USERS
Media, NGOs, and interest groups

INDICATORS
Decreased instances of corruption, improved allocation of aid money

INTENDED IMPACT
Improving governance

RESPONSE TO NEPALESE EARTHQUAKE

DESCRIPTION

In the wake of the devastating earthquake that struck Nepal in 2015, so-called "digital humanitarians" — both local and international volunteers — took it upon themselves to create detailed maps in the most affected areas.[72] One such platform, Quakemap.org, allowed citizens to report needs to organizations that provide relief — with 434 of 551 actionable reports acted upon.[73] This response built upon an already robust mapping project in Nepal and demonstrates how open data efforts can work in collaboration with humanitarian relief efforts at both the local and international level.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open geospatial data, crowdsourced data

ACTORS
NGOs, private sector

ACTIVITY
Presentation, dissemination

OUTPUT
Maps, process improvements

USERS
Government officials, citizens

INDICATORS
Lives saved

INTENDED IMPACT
Solving public problems

OPEN AID AND BUDGET DATA IN NEPAL

DESCRIPTION

The early impact of a project in Nepal to open aid and budgetary data held by the government has shown limited impact to date, likely due to the political and economic reality of the nation, which is rebuilding from decades of civil unrest and governance breakdown. Political, legal, and technical realities present significant challenges to advocates of greater digital transparency, key stakeholders interviewed demonstrated widely-varying perceptions of what "open data' meant, stakeholders viewed themselves more as facilitators than end-users, and government data quality was called into question by several experts.[74]

LOGIC FRAMEWORK COMPONENTS

INPUT
Open aid and budget data

ACTORS
NGOs

ACTIVITY
Data analysis, disseminatio

OUTPUT
Searchable databases

USERS
Citizens, NGOs and interest groups

INDICATORS
Lives saved

INTENDED IMPACT
Improving government

AGRICULTURE AND NUTRITION

Improving Governance

Open data can make agricultural agencies and implementing organizations more accountable, by making information accessible on whether or not financial resources provided were used according to contractual obligations; and whether they serve people and farmers they are supposed to be supporting.

Solving Public Problems

On a micro level, open data can play a role in both predicting potentially damaging conditions for crops, and informing more strategic planting choices following, for example, a catastrophic weather event.
At the macro level, the increased availability of usable data on climate can help governments to advance a forward-looking sectoral approach to the end of ensuring food security in the future.

Innovation & Creating Opportunity

An increased awareness of weather trends, models of crop yields and other relevant datasets can help inform more strategic, evidence-based agricultural decision making and increase the viability of individual farms.

Empowering Citizens

A major problem in developing countries is the different levels of food access across populations, with research pointing to the emergence of "food deserts" in Africa's urban centers.[75] Open data that pertains to regional food access can allow citizens to identify these disparities in nutrition and food access, empowering citizen groups to lobby government institutions for more equitable food policy. In addition, smallholder farmers could be full participants in defining, implementing, and evaluating projects intended to improve their farms and lives when provided access to data.

Levi Morsy - Unsplash

EXAMPLES[76]

UGANDA'S BANANA BACTERIAL WILT SOLUTION

DESCRIPTION

Faced with a crisis caused by the spread of banana bacterial wilt (BBW), the Ugandan government turned to open data included in U-Report (http://ureport.ug), UNICEF's community polling project. U-Report helped spread awareness of the disease, mobilized a network of nearly 300,000 volunteers across the country, and also provided vital information to the government about the disease and its pattern of spreading. Using U-Report, the government was able to disseminate information (via SMS) about treatment options and actionable crop-protection strategies to some 190,000 citizens.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open international organization data, crowdsourced data

ACTORS
Government officials, international organization

ACTIVITY
Aggregation and commingling dissemination

OUTPUT
Apps and platforms, data-driven journalism

USERS
Citizens, media

INDICATORS
Crops and money saved

INTENDED IMPACT
Solving public problems

UGANDA'S BANANA BACTERIAL WILT SOLUTION

DESCRIPTION

The production of rice is in a state of continual decline, adversely affecting local farmers. These trends are often blamed on the shifting climate. Researchers analyzed climate and meteorological data alongside measures of rice production and found that the most commonly planted rice in the region, Cimarron Barinas, is highly sensitive to changes in temperature. As a result, farmers adjusted when they planted the crop. Farmers were thus able to improve their yield and protect themselves from the environment. It is estimated that $3.5 million in potential losses were avoided as a result.[77]

LOGIC FRAMEWORK COMPONENTS

INPUT
Open climate and agricultural data, semi-public agricultural data

ACTORS
NGOs and researchers

ACTIVITY
Data analysis

OUTPUT
Decision trees, apps and platforms, searchable databases

USERS
Citizens, Industry groups

INDICATORS
Money saved by smallholder farmer

INTENDED IMPACT
Creating opportunity

IMPROVING THE GLOBAL FARMING KNOWLEDGE BASE

DESCRIPTION

To combat the pests and diseases responsible for killing 40 percent of the world's planted crops each year, Plantwise (https://www.plantwise.org) combines a diversity of relevant global and local databases, government data, and research publications in an openly accessible platform to improve decision making related to pests and disease. This tool has been accessed by over 600,000 farmers from 198 countries, who have contributed to over 900,000 factsheets on crop pest prevalence and best practices to help manage and prevent potential crop loss from pests and diseases.[78]

LOGIC FRAMEWORK COMPONENTS

INPUT
Open agriculture data, open science data, open international organization data

ACTORS
NGOs

ACTIVITY
Data analysis, aggregation and commingling, dissemination

OUTPUT
Apps and platforms, advocacy

USERS
Citizens, industry groups

INDICATORS
Crops and money saved

INTENDED IMPACT
Empowering citizens

EMPOWERING SMALLHOLDER FARMERS IN GHANA

DESCRIPTION

Esoko is a for-profit company, with close relationships with the public sector, offering a simple communication tool for businesses, government, NGOs, and others to connect with farmers. Managed from its main office in the capital city of Accra, Esoko is principally directed at businesses, while individual farmers only constitute its secondary group of interest. Nevertheless, the information that Esoko provides to farmers by repackaging data from different sources (including government and crowdsourced data) and disseminating the information via mobile phones with call-center support in local languages gives smallholder farmers a new addition to their toolkit — that is, if they are made aware of the opportunity to the extent needed for a meaningful impact. In addition, Farmerline, a mobile communications organization, offers similarly data-driven offerings to smallholder farms in Ghana.[79]

LOGIC FRAMEWORK COMPONENTS

INPUT
Open agriculture data, crowdsourced data

ACTORS
Private sector

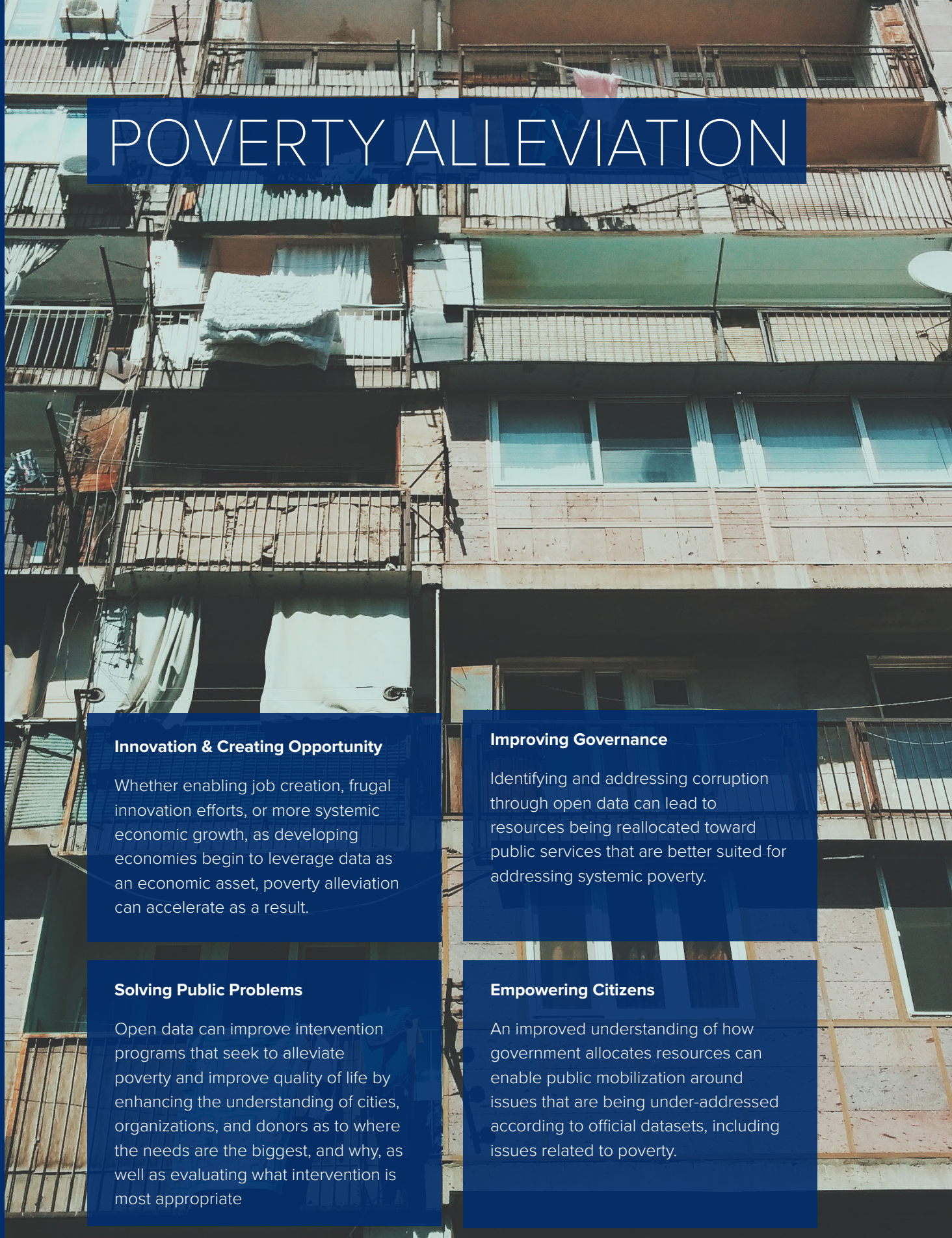
ACTIVITY
Data analysis, dissemination

OUTPUT
Decision trees, apps and platforms, searchable databases

INDICATORS
Crops and money saved by smallholder farmers

INTENDED IMPACT
Creating opportunity

POVERTY ALLEVIATION



Innovation & Creating Opportunity

Whether enabling job creation, frugal innovation efforts, or more systemic economic growth, as developing economies begin to leverage data as an economic asset, poverty alleviation can accelerate as a result.

Improving Governance

Identifying and addressing corruption through open data can lead to resources being reallocated toward public services that are better suited for addressing systemic poverty.

Solving Public Problems

Open data can improve intervention programs that seek to alleviate poverty and improve quality of life by enhancing the understanding of cities, organizations, and donors as to where the needs are the biggest, and why, as well as evaluating what intervention is most appropriate

Empowering Citizens

An improved understanding of how government allocates resources can enable public mobilization around issues that are being under-addressed according to official datasets, including issues related to poverty.

Gor Davtyan - Unsplash

EXAMPLES

CODE FOR AFRICA

DESCRIPTION

Unlike North America and Europe, countries in Africa often have limited access to open government data, and are consequently also limited in their ability to harness technology and use it as a driver of growth. Code for Africa (https://codeforafrica.org) aims to nurture skills in technology and coding from within communities to create opportunities for citizens to act as watchdogs for governments, corporations and public institutions. Fundamental to this is seeing civic technology and open data as potential public assets, and Code for Africa has developed a Data Fellowship program that embeds people trained in data skills to work on projects in a variety of media and nonprofit organizations. School of Data offers a similar fellowship program aimed at increasing data skills and literacy and putting them to use in local partner organizations around the world.80 By nurturing this burgeoning field, Code for Africa's projects have in turn interrogated public expenditure, as seen in the platform 'Where My Money Dey?'81 which tracks open data on public revenues received from mining companies. This effort is aimed at providing citizens, NGOs, and watchdogs with information that can help ensure communities benefit from large industrial projects on their land.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open budget data

ACTORS
NGOs

ACTIVITY
Data analysis, presentation, dissemination

OUTPUT
Apps and platforms, process improvements

USERS
Media, researchers

INDICATORS
Decreased corruption in extractives industry

INTENDED IMPACT
Improving government, empowering citizens

BHOOMI PROJECT

DESCRIPTION

This project in Karnataka, India, was intended to install kiosks in local communities that would provide access to newly digitized land records and democratize the flow of information, reduce inequality, and empower the poor. The system, however, was widely exploited by richer members of society, which weakened the social standing of poorer citizens, exactly the opposite of the goal of the project. Despite its good intentions, the project largely resulted in the transfer of wealth from poor to rich in those communities due to pre-existing inequalities in access to information.[82]

LOGIC FRAMEWORK COMPONENTS

INPUT: Open land record data

ACTORS: NGO

ACTIVITY: Dissemination

OUTPUT: Searchable database

USERS: Citizens

INDICATORS
Increased use of land record information by the poor

INTENDED IMPACT
Empowering citizens

ENERGY

Innovation & Creating Opportunity

The use of open energy data to bolster predictive capabilities and reel in energy expenditures could have wide-ranging economic impacts for both the public and private sectors.

Solving Public Problems

An improved understanding of energy consumption patterns (at the aggregate and/or individual level) can help individuals, organizations, and policymakers take concrete steps toward decreasing consumption and addressing climate impacts.
Open data from various sources can help decision makers prioritize investments in energy production and delivery.

Ostill - Shutterstock

EXAMPLES

AZERBAIJAN'S EXTRACTIVE INDUSTRIES TRANSPARENCY INITIATIVE EFFORTS

DESCRIPTION

The Extractive Industries Transparency Initiative (EITI) is a global partnership that requires member countries to provide open data and information on the governance of oil, gas, mining, and other extractives. Though questions remain about the line between true impact and positive public relations (see "open washing" discussion above), Azerbaijan, one of the earliest compliers to the EITI standards, saw its "double-digit discrepancies between corporate receipts and government intakes" — an indicator of corruption — essentially disappear between 2003 and 2009. The World Bank Independent Evaluation Group went on to rate the country's EITI efforts as "highly effective."[84] This example, however, also points to the frequency of backsliding in open initiatives, and the challenges created by the political contexts in which open data initiatives are launched. In 2015, Azerbaijan's EITI membership status was downgraded due to crackdowns on civil society, political opponents, and the media. In 2017, the country's membership was suspended entirely.[85]

LOGIC FRAMEWORK COMPONENTS

INPUT
Open extractive industry data

ACTORS
NGO

ACTIVITY
Dissemination

OUTPUT
Searchable databases

USERS
NGOs and interest groups, researchers, government officials

INDICATORS
Reduced discrepancies between government and contracting business receipts

INTENDED IMPACT
Improving governance

Empowering Citizens

By providing more information to citizens about energy consumption — including perhaps individualized information about their own habits, as offered by GreenButton in the United States[33] — citizens can make more informed decisions regarding usage and, as a result, decrease their energy spending. Open data on utility services and pricing can also be used to identify the best-priced service.

Improving Governance

Like the health sector, energy is the subject of significant public money expenditures, and government sponsorship and procurement (especially in the extractives field). Improving the transparency of a country's energy budget could potentially identify and prevent corruption.
In addition, open datasets such as open address data, can improve service delivery by providing energy companies and government with a better understanding of current conditions.

INDIA'S ELECTRICITY SUPPLY MONITORING INITIATIVE

DESCRIPTION

The poor quality of energy infrastructure in India results in frequent shortages, blackouts, and interruptions. The Indian government does not consistently provide open data on these energy issues. In response to this, the Electricity Supply Monitoring Initiative (ESMI) was launched in 2014 by the Pune-based non-profit Prayas Energy Group. ESMI collects information from cities across 200 locations in India through electricity supply monitors (ESMs) — devices installed in key sites to record voltage data, which log this information with a central server. This data is then made publicly available through the website watchyourpower.org, where users can monitor their power supply and compare this with other regions. ESMI has collected one million location-hours of data, and already found that rural areas experience four to five times more power disruptions than cities or districts. ESMI has already surfaced important evidence about the Indian power supply, but whether and how the capture of this evidence will create meaningful change remains an open question, dependent on an institutional willingness to act upon insights generated — a willingness that has not yet surfaced.

LOGIC FRAMEWORK COMPONENTS

INPUT
Energy provider data

ACTORS
NGO

ACTIVITY
Data analysis

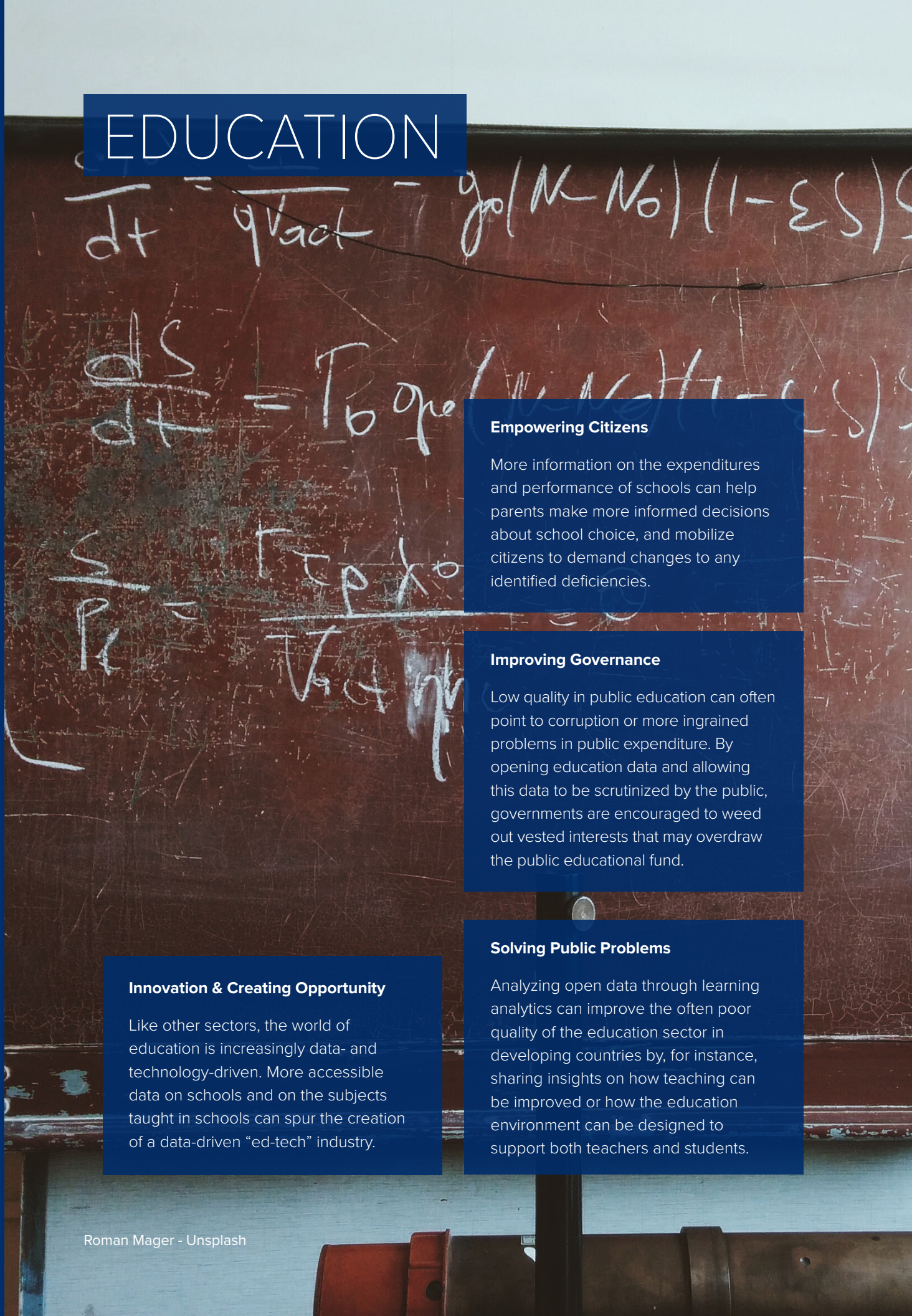
OUTPUT
Dashboards, searchable databases

USERS
Citizens, corporations, researchers, government officials

INDICATORS
Improved power supply, increased citizen advocacy around energy

INTENDED IMPACT
Empowering citizens

EDUCATION



Empowering Citizens

More information on the expenditures and performance of schools can help parents make more informed decisions about school choice, and mobilize citizens to demand changes to any identified deficiencies.

Improving Governance

Low quality in public education can often point to corruption or more ingrained problems in public expenditure. By opening education data and allowing this data to be scrutinized by the public, governments are encouraged to weed out vested interests that may overdraw the public educational fund.

Solving Public Problems

Analyzing open data through learning analytics can improve the often poor quality of the education sector in developing countries by, for instance, sharing insights on how teaching can be improved or how the education environment can be designed to support both teachers and students.

Innovation & Creating Opportunity

Like other sectors, the world of education is increasingly data- and technology-driven. More accessible data on schools and on the subjects taught in schools can spur the creation of a data-driven “ed-tech” industry.

Roman Mager - Unsplash

Doug Linstedt - Unsplash

EXAMPLES

MEXICO'S MEJORA TU ESCUELA

DESCRIPTION

Founded by the Mexican Institute for Competitiveness (IMCO), with support from Omidyar Network and others, Mejora Tu Escuela (http://mejoratuescuela.org) is an online platform that provides citizens with information about school performance. It helps parents choose the best option for their children, empowers them to demand higher quality education, and gives them tools to get involved in their children's schooling. It also provides school administrators, policymakers, and NGOs with data to identify areas that require improvement and hotbeds of corruption, in the process raising the overall quality of education in Mexico. Some of the data used to create the Mejora Tu Escuela platform was also instrumental in identifying widespread corruption in the education sector and targeting public outrage regarding "phantom" teachers on school payrolls, unchecked teacher absenteeism, and misappropriated funds, among other issues.[86]

LOGIC FRAMEWORK COMPONENTS

INPUT: Open education performance and budget data

ACTORS: NGO

ACTIVITY
Data analysis, aggregation and commingling, dissemination

OUTPUT
Dashboards, research report

USERS
Citizens, media, NGOs and interest groups, government officials

INDICATORS
Reductions in education corruption, education advocacy efforts

INTENDED IMPACT
Empowering citizens

BRAZIL AND EDUCATION MONITORING

DESCRIPTION

The development of QEdu[87] in Brazil highlights the link between improved educational standards and open data initiatives. The database — which monitors state, county, and school performance based on metrics like test scores, census data, and educational spending — is easily searched and freely accessible. Reliable data can allow school managers to implement more targeted reforms and allow parents to understand the system that is educating their children. Similar projects have been undertaken in Mexico, Kenya, Tanzania, and the Philippines and appear to be meeting with success.

LOGIC FRAMEWORK COMPONENTS

INPUT: Open education performance and budget data, census data

ACTORS: NGOs, researchers

ACTIVITY
Aggregation and commingling, dissemination

OUTPUT: Searchable databases

USERS
Citizens, NGOs and interest groups, government officials

INDICATORS
Money saved in education, education advocacy efforts

INTENDED IMPACT
Empowering citizens and improving government

TANZANIA'S EDUCATION DASHBOARDS

DESCRIPTION

Two recently established portals in Tanzania tried to improve low national examination pass rates, providing the public with more data on education and Tanzania's schools. The first, the Education Open Data Dashboard (educationdashboard.org), is a project established by the Tanzania Open Data Initiative, a government program supported by the World Bank and the United Kingdom Department for International Development (DFID) to support open data publication, accessibility and use. The second, Shule (shule.info), was spearheaded by a lone programmer, entrepreneur, and open data enthusiast who has developed a number of technologies and businesses focused on catalyzing social change in Tanzania. Although these projects initially encouraged citizens to demand greater accountability from their school system and public officials, both are in a state of near abandonment resulting from the lack of a clear sustainability and long-term management strategy.

LOGIC FRAMEWORK COMPONENTS

INPUT
Open education performance data

ACTORS
NGO, private sector entrepreneurs, donor organizations

ACTIVITY
Aggregation and commingling, dissemination

OUTPUT
Dashboards

USERS
Citizens, media

INDICATORS
Education advocacy efforts

INTENDED IMPACT
Empowering citizens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IV. HOW CAN OPEN DATA BE LEVERAGED AS A NEW ASSET FOR DEVELOPMENT?

The preceding discussion has relied on a wide variety of emergent evidence to better understand how, when, and under what conditions open data projects succeed and fail in developing economies. Our goal, as indicated at the outset, has been neither to champion nor denigrate the potential of open data. The available evidence indicates a mixed picture, with open data resulting in meaningful impact in some cases, and less so in others. Identifying the signal in current research and practice is challenging since the field is still largely built around a belief in the potential of open data and a few compelling yet anecdotal success stories. Our effort here has been to understand specific pathways — using a logic model — by which open data operates in developing economies. This logic model can inform future research and evidence gathering toward a more conclusive understanding of open data's true impacts on development.

Our broad conclusion, supported by the literature, stories, and examples contained in the case studies, are that the theory of change being advanced in the field of open data for development is built around the premise that open data can:

- **Improve governance,** specifically by enhancing transparency and accountability, introducing new efficiencies into service delivery, and increasing information sharing within government departments
- **Empower citizens** in developing countries by improving their capacity to make decisions and widen their choices, and also by acting as a catalyst for social mobilization
- **Create economic opportunity,** notably by enabling business creation, job creation, new forms of innovation and more generally spurring economic growth
- **Help solve complex public problems** by improving situational awareness, bringing a wider range of expertise and knowledge to bear on public problems, and by allowing policymakers, civil society, and citizens to better target interventions and track impact

Again, none of these impacts are inevitable; they are currently better understood as intended rather than realized impacts. As part of our broader logic open data model, we have identified a number of enabling conditions and disabling factors — phenomena or aspects that may spur the potential of open data in developing economies. In particular, the impact of open data in developing economies depends upon:

- **Problem and Demand Definition**: whether and how the problem to be addressed and/or the demand for open data are clearly defined and understood
- **Capacity and Culture**: whether and how resources, human capital and technological capabilities are sufficiently available and leveraged meaningfully
- **Partnerships**: whether and how collaboration within and, especially, across sectors using open data exists
- **Risks**: whether and how the risks associated with open data are assessed and mitigated
- **Governance**: whether and how decisions affecting the use of open data are made in a responsive and legitimate manner

The accompanying Periodic Table of Open Data Impact Elements, outlined in Part II (See Appendix C for full version) details the enabling conditions and disabling factors that must be taken into account. The list can be used as a checklist of elements that are essential to keep in mind whenever designing or funding open data projects since they may determine the difference between success and failure.

We conclude this paper with six take-aways and subsequent recommendations for open data practitioners and decision makers, such as donor agencies, on how to leverage open data as a new asset for development. They represent an initial effort to operationalize the above discussion, and are derived from the empirical evidence in the case studies conducted as part of this project. Considered together, they amount to something of a "roadmap" of open data project design, implementation, and monitoring within developing economies.

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DEFINE THE PROBLEM, UNDERSTAND THE USER

Focus on and define the problem, understand the user, and be aware of local conditions. The most successful open data projects are those that are designed and implemented with keen attention to the nuances of local conditions, have a clear sense of the problem to be solved, and understand the needs of the users and intended beneficiaries. Projects with an overly broad, ill-defined, or "fuzzy" problem focus, or those that have not examined the likely users, are less likely to generate the meaningful real-world impacts, regardless of funds available. Too often open data projects have less impact because they are overly focused on leveraging newly available technology or datasets rather than being problem- and user-focused.

Sai Kiran Anagani - Unsplash

Ryan Wallace - Unsplash

RECOMMENDATIONS FOR OPEN DATA PRACTITIONERS

- Articulate the issue to be addressed with as much granularity as possible.
- Identify and seek to understand the needs of the intended users and beneficiaries (including data intermediaries/partners such as NGOs or journalists) of the open data effort (potentially using user-centric design methods).
- Clearly define why the use of data for addressing the problem matters.
- Explore existing work that seeks to address the problem (locally or otherwise) and how your open data efforts are complementary.

RECOMMENDATIONS FOR DECISION MAKERS (INCLUDING DONOR AGENCIES)

- Seek to promote problem- or demand-focused open data policies and strategies where open data can provide value.
- Seek ways to strengthen the capacity toward problem definition and user-centric research, for instance, by developing common problem definitions or user research tools and decision trees that can be used by practitioners.
- Develop and integrate — or ask your partners or grantees to conduct — regular exercises that identify how open data could contribute to the problem(s) one seeks to address (as to generate a data-demand culture).
- Invest in research that maps and seeks to create a better understanding of the demand side of data that can or could be matched with the current or future supply side of open data (including, for instance, a list of questions and problems that can complement the list of data-sets released).
- Invest in the development of data-capturing tools that can be used toward specific ends (such as opening information on results-based financing efforts) but have the flexibility to be applied in varied contexts.
- Require grantees to complete a "canvas" or diagnostic of open data project design to demonstrate that the problem and theory of change have been well-defined and to provide the basis for conversation between donor and recipient about the use of data.

READINESS, RESPONSIVENESS, CHANGE MANAGEMENT

Focus on readiness, responsiveness, and change management. Implementing open data projects often requires a level of readiness among all stakeholders, as well as a cultural transformation in the way governments and institutions collect, share, and consume information. For development funders, this important determinant of success can imply difficult decisions regarding high-potential open data initiatives in developing economies that lack clear institutional readiness or demonstrated responsiveness to feedback. The existence of a robust ICT4D sector, such as that found in Ghana, can act as a catalyst for the quick and effective development of open data capabilities. Moreover, commitment and buy-in from international development agencies themselves can play a key role in establishing the readiness necessary for impact, as evidenced in cases like Burundi's Open RBF efforts.

RECOMMENDATIONS FOR PRACTITIONERS

- Consider the institutional culture(s) and "readiness" of the relevant data providers, data intermediaries, and data users that may impact both the supply of data and the response to or use of the insights generated.
- Explore partnerships with providers, partners, or intermediaries with capabilities that could help fill existing capacity gaps.
- Develop internal data literacy training opportunities.

RECOMMENDATIONS FOR DECISION MAKERS (INCLUDING DONOR AGENCIES)

- Develop and/or fine-tune data-readiness assessment tools that can help determine the true potential of releasing and leveraging open data in developing economies.
- Invest in the generation and dissemination of evidence that can strengthen the value proposition of open data toward increasing political will to open up datasets.
- Invest in or develop coaching efforts that can nurture data-readiness and a data-driven culture at the supply, demand, and use sides of the open data ecology.
- Consider the creation of new "data intermediaries" and/or seek to support existing intermediaries (such as journalists or libraries) that can bridge the data-gap.
- Develop roadmaps to prevent or address the growing divide between those who have access and capacity to leverage data and those who do not.

OPEN DATA ECOSYSTEM THROUGH COLLABORATION

Nurture an open data ecosystem through collaboration and partnerships. Data does not exist in isolation. The success of open data projects relies on collaboration among various stakeholders, as well as collaboration with data scientists and topic or sector experts. During the problem definition and initial design phase, practitioners and funders should explore the types of collaborations that could increase uptake and impact. Such partnerships could, for example, take place with other data providers (perhaps from different sectors), like-minded international or local organizations, as well as established intermediaries such as journalists or industry groups.

RECOMMENDATIONS FOR PRACTITIONERS

- Conduct due diligence on important actors in the field relevant to the initiative.
- Explore, in particular, private-sector data holders that could be incentivized to participate in a data collaborative (complementing open government data).
- Build bridges with cross-sector stakeholders in the problem and solution (i.e., open data) spaces, for example, by attending conferences or meetups.
- Establish mechanisms and agreements to enable ongoing collaboration between identified partners.

RECOMMENDATIONS FOR DECISION MAKERS (INCLUDING DONOR AGENCIES)

- Promote collaboration and dialogue among and between the supply (including national statistical agencies and corporate actors) and demand side of open data.
- Develop methodologies that can help identify different demand segments and/or constituencies that can leverage open data toward their mission.
- Invest in "labs" and creating those structures in which different partners can freely collaborate and exchange expertise toward solving hard problems.
- Develop and/or strengthen problem-solving and expert networks seeking to address sustainable development challenges with open data.
- Develop and/or fine-tune common agreements that can accelerate partnerships and exchange of data and expertise.
- Support the organization of and participation in events where different actors (global, regional, and national) can connect and identify common solutions toward improving the open data eco-system.

RISK MITIGATION STRATEGY

Have a risk mitigation strategy. Open data projects need to be mindful of some of the important risks associated with even the most successful projects. Notably, these risks include threats to individual privacy (for example, through insufficiently anonymized data) and security. Funders should ensure that projects dealing in information that is potentially personally identifiable (including anonymized data) have audited any data risks and developed a clear strategy for mitigating those risks before proceeding with the partnership.

RECOMMENDATIONS FOR PRACTITIONERS

- Assess how the data will be accessed and used, including ways that might not represent the central intended use case(s).
- Conduct a data inventory to determine how the data will be stored and monitored, and who can gain access to the data.
- Consider risk-producing scenarios or use cases to help target a mitigation strategy.
- Develop risk counter-measures based on these scenarios, such as data handling policies, training, technological solution (for example, to de-identify personal information) and a data ethics framework.

RECOMMENDATIONS FOR DECISION MAKERS (INCLUDING DONOR AGENCIES)

- Seek ways to complement the value-proposition of open data with a broader awareness of the risks involved — for instance, through an effort to collect (learn-by-failure) case studies or stories that illustrate what can go wrong.
- Support or develop "data responsibility" models, including decision trees or expert systems that enable responsible decision making at each stage of the data life cycle (collecting, processing, sharing, analyzing, and using);

BUILD EVIDENCE AND SUSTAINABILITY

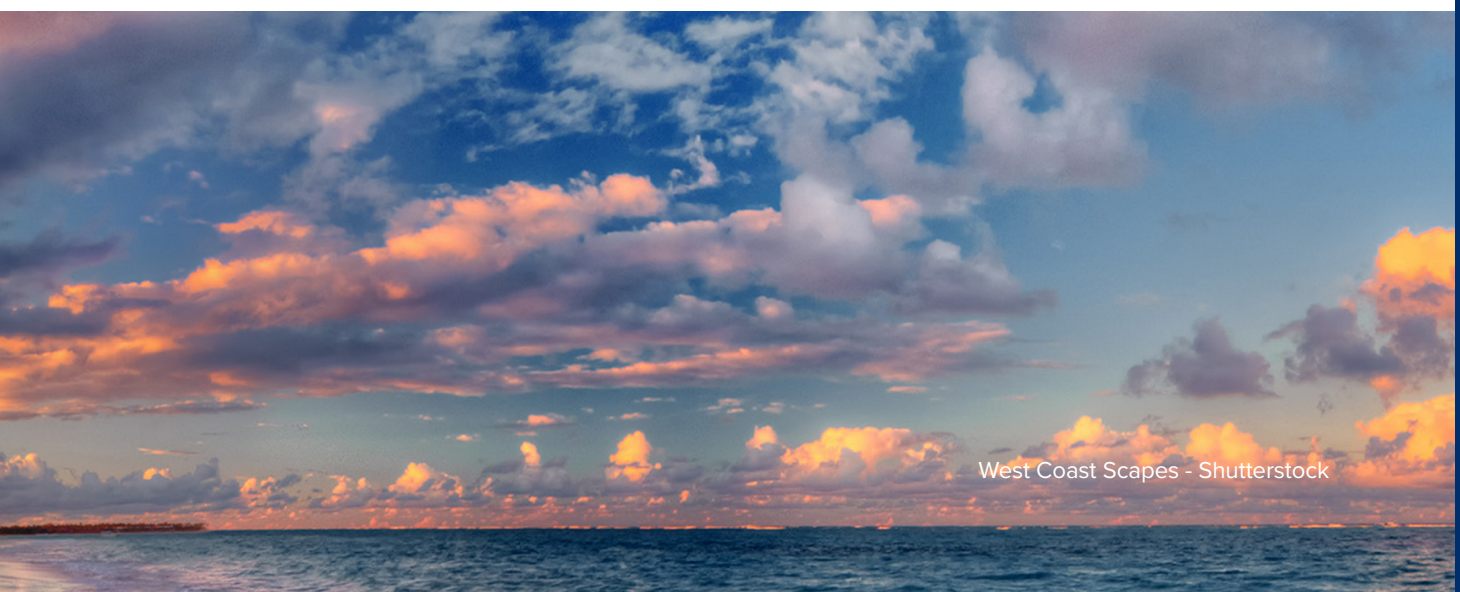
Secure resources, build evidence, and focus on sustainability. Open data projects can often be initiated with minimal resources, but require funding and additional sources of support to sustain themselves and scale. It is important to recognize that access to funding at the outset is not necessarily a sign that open data projects are destined for success. A longer term, yet flexible, business model or strategy is a key driver of sustainability, and should be developed in the early stages of the design process.

RECOMMENDATIONS FOR PRACTITIONERS

- Identify local and international funders active in the sector or vertical problem area to be addressed, or in the use of data and technology to solve public problems.
- Determine how long current funding streams will be sufficient for sustainability.
- Explore and learn about additional funding or revenue generation options (e.g., tiered pricing models for open data-driven business offerings).

RECOMMENDATIONS FOR DECISION MAKERS (INCLUDING DONOR AGENCIES)

- Develop assessment methodologies that can help identify the cost and resources necessary to sustain open data initiatives, such as the World Bank's Open Government Data Toolkit, the Open Governance Costing project being advanced by the World Bank and Research Consortium on the Impact of Open Government Processes.[88]
- Coordinate and increase funding resources — for instance, by allocating an (open) data line in each budget proposal.



West Coast Scapes - Shutterstock

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STRONGER EVIDENCE AND SUPPORT RESEARCH

Build a stronger evidence base and support more research. This paper sought to capture the narratives, practice, and evidence around open data's uses in developing economies. Although there are some early, often muted signals pointing to the impacts of open data for development, the field is still largely built on a belief that open data is creating demonstrable positive outcomes. To move to a more evidence-based understanding of open data in developing economies, we distilled a theory of change and analytical framework informed by the current practice, not to further entrench faith in the positive narrative surrounding open data, but to create a flexible analytical framework that can inform future research and impact assessment. We identified a number of premises — in the form of apparent enabling conditions and disabling factors for open data initiatives — but these premises need further study (and scrutiny) by the research field to determine whether or not they hold water in practice. Thus we end with a call for more research; if open data is to reach its significant, and much-discussed, potential for spurring development, we need to move beyond ideology to create a systematic understanding and evidence base regarding what open data's impacts have been to date and how positive impacts can be enabled.

RECOMMENDATIONS FOR OPEN DATA PRACTITIONERS

- Embed research and analysis of what works in the design of the open data initiative allowing for both more iterative approaches and long-term insights into how to improve certain variables.
- Integrate lessons learned and research findings into the design and development of open data initiatives (toward a more evidence-based design process).

RECOMMENDATIONS DECISION FOR MAKERS (INCLUDING DONOR AGENCIES)

- Support more research and the further development and implementation of assessment frameworks (as provided in this paper) that can help identify what works and what doesn't; as well as what can be used to scale open data initiatives across developing economies (including the possible creation of "what works labs" in different regions).
- Seek ways to translate and disseminate existing research and evidence into an "open data canvas" (akin to the GovLab Public Projects Canvas[89]), using the Periodic Table we developed in this paper, that can guide more informed approaches to leverage scarce resources and ensure that interventions do not reinforce existing power or economic inequities.

Finally, given the nascent nature of existing open data initiatives, the signals of open data's impact in developing economies are still largely muted, as evidenced in the examples discussed in our paper. Our goal in this paper was not to use these examples as the ultimate proof of open data's importance for development; rather, we have picked up these signals and placed them into an analytical framework to enable further practice and analysis going forward. It is only with this type of structured analysis that we can gain a systematic and comparative evidence base of whether and how open data is meaningfully impacting on-the-ground conditions in developing economies.

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REMAINING QUESTIONS AND EVIDENCE GAP

Although much research has contributed to our understanding of how and when open data works, there remain several questions that could benefit from more evidence and research. For instance:

Matching supply and demand

- How can we identify and unlock currently closed datasets that are likely to have a real-world impact, while avoiding "open-washing" — i.e., the tendency of governments to characterize data releases of questionable impact as examples of "open data" as a means for improving reputation?
- How can we better match the supply of open data to the demonstrated demand for data among communities of use, and, as a result, minimize instances of scarce resources being used to open data with low potential for use and impact?

Building capacity and an institutional open data culture

- How can developing countries build open data capacity, e.g., technical readiness, culture change, and training, necessary to maximize positive impacts and avoid potential harms?
- How does the average cost of building open data capacity differ between developing and developed countries?
- How does one establish a data-driven mindset and sense of responsibility among decision makers in developing economies that would generate a commitment and willingness to act upon the insights gained from open data?
- How can development agencies accelerate the supply and responsible use of open data and share their own data with a broader range of constituencies, including governments, NGOs, educational institutions, business hubs, and other donor organizations?
- How can we strategize and implement institutional and cultural change, including within international development organizations, to amplify the impact of open data in developing economies?

Building an open data ecosystem

- How can we better capture the direct effects of impact enablers — like intermediaries — to help practitioners target efforts?

Risks and challenges

- How can we avoid entrenching existing power asymmetries and inequalities — both socio-economic and digital — when much of the marginalized community in developing countries is not represented in official datasets?
- How can we minimize the potential privacy and security harms resulting from the opening of more government data?

APPENDIX A

LIST OF OPEN DATA IN DEVELOPING ECONOMIES CASE STUDIES

odimpact.org

Burundi: Open Results and Performance Based Financing — As part of efforts to improve health outcomes and health system functioning, Burundi was one of the first African countries to introduce results based financing (RBF). RBF is an instrument that links development financing with pre-determined results. Payment is made only when the agreed-upon results are shown to have been achieved. OpenRBF — a platform for opening data related to RBF initiatives — was first delivered in Burundi in response to the Burundian Ministry of Health's efforts to improve health care functioning at the national level and strengthen accountability mechanisms. Early returns were positive; OpenRBF engaged in a longer term partnership with the government. OpenRBF was concurrently applied to education programs and to AIDS awareness programs in Burundi.

Cambodia: Opening Development Data — Developed by the East-West Management Institute, and part of the broader Open Development Initiative, Open Development Cambodia (ODC) seeks to improve public awareness and information-sharing around development data. ODC seeks to use data aggregated from a diversity of governmental and nongovernmental sources to provide visualizations, maps, and other data-driven products and tools to inform the public sector, private sector, civil society, data-driven journalists, and the general public as to the workings and impacts of development efforts.

Colombia: Establishing Climate Resilience in Agriculture — In Colombia, as in many other places around the world, the effects of climate are increasingly evident. One sector that has been particularly hard hit is agriculture. Unanticipated weather shifts and extended drought periods have created major challenges for the country's farms, perhaps especially for small, independently owned farms. The Aclímate Colombia project is a cross-sector partnership led by the International Center for Tropical Agriculture (CIAT), a civil society organization, with private-sector industry groups and government actors. The platform (available at aclimatecolombia.org) leverages a diversity of data sources, including many open government datasets, to help farmers understand how to better navigate shifting weather patterns. Although still relatively young, Aclímate Colombia has already had a tangible impact and received widespread recognition. It is a powerful example of how data-sharing across sectors — along with the use of sector-relevant intermediaries — can take high-level data science insights and translate them into concrete, actionable information, in the process helping farmers increase their livelihoods.

Ghana: Empowering Smallholder Farmers — Esoko is a simple but powerful communication tool for businesses, government, NGOs, and others to connect with farmers. Esoko is a for-profit company that maintains close relationships with the public sector. Managed from its main office in the capital city of Accra, Esoko is principally directed at businesses, while individual farmers only constitute its secondary group of interest. Nevertheless, the information that Esoko provides to farmers by repackaging data from different sources (including government and crowdsourced data) and disseminating the information via mobile phones with call-center support in local languages, has the potential to be of benefit to farmers. One of the principal objectives of Esoko has always been to empower smallholder farmers.

India: Open Energy Data — In 2007, The Prayas Energy Group (PEG), an Indian NGO, launched the Electricity Supply Monitoring Initiative (ESMI) to collect real-time power quality information by installing Electricity Supply Monitors (ESM) in various locations in the city of Pune, India. The initiative was part of an ongoing effort by consumer groups and regulators in the Indian state of Maharashtra to monitor power quality after numerous complaints about frequent interruptions and power outages. Having been involved in evidence-based advocacy in the Indian power sector since the early 1990s, Prayas was aware of these issues and created the ESM initiative in line with its "proactive approach to point out gross inefficiencies" and to bring Transparency, Accountability and informed Participation (TAP) to the power sector. The organization has also carried out numerous regulatory and policy interventions covering areas such as capacity addition, capital expenditure in transmission and distribution, and service delivery to unelectrified consumers.

Jamaica: Open Data to Benefit Tourism — Like much of the Caribbean, the Jamaican economy is strongly dependent on the health of its tourism industry. Influenced by the rise of all-inclusive resorts and a general disincentive for tourists to stray far from a few highly trafficked areas, tourists rarely experience much of Jamaica's unique culture, and the economic benefits of tourism are often concentrated in a few areas. To increase tourism (and the spread of its positive impacts), a community mapping project[90] is seeking to combine open government data with crowdsourced mapping data to enable the more participatory development of the tourism sector. Built around open tourism data and the engagement of government agencies, civil society organizations, developers, and an interested group of community mappers, the initiative is providing early insight into how data and collective intelligence can impact an industry that in many ways represents the lifeblood of the country.[91]

Kenya: Improving Voter Turnout with Open Data — Kenya's national Independent Electoral and Boundaries Commission (IEBC) released information about polling center locations on its website in the lead up to Kenya's 2013 general election. The information was difficult to access and reuse, however. Seizing on the gap between opening government data and citizens' actual ability to use that data, two Code 4 Kenya fellows conducted an experiment in unlocking government data to make it useful to the public. The fellows scraped the released IEBC data and built a simple website where it could be more easily accessed. The result was the initial version of GotToVote!, a site that provided citizens with voter registration center information, and also helped them navigate the sometimes complex world of registration procedures. This first version was developed in just 24 hours at zero cost.

Nepal: Open Data to Improve Disaster Relief — In the wake of the devastating earthquake that struck Nepal in 2015, so-called "digital humanitarians" — both local and international volunteers — took it upon themselves to create detailed maps of the most affected areas. One such platform, Quakemap.org, allowed citizens to report needs to organizations providing relief — 434 of 551 actionable reports were acted upon. This response built upon an already robust mapping project in Nepal and is a powerful demonstration of the positive benefits of open data efforts working in collaboration with humanitarian relief efforts at both the local and international level.

Paraguay: Predicting Dengue Outbreaks with Open Data — Since 2009, dengue fever has been endemic in Paraguay. Recognizing the clear problem at hand, and the lack of a strong system for communicating dengue-related dangers to the public, the National Health Surveillance Department of Paraguay opened data related to dengue morbidity. Leveraging this data, researchers created an early warning system that can detect outbreaks of dengue fever a week in advance. The data-driven model can predict dengue outbreaks at the city level in every city in Paraguay. Importantly, the system can be deployed in any region as long as data on morbidity, climate, and water are available.

South Africa: Code for South Africa Cheaper Medicines for Consumers — In 2014, Code for South Africa, a South Africa-based nonprofit organization active in the open data space, took a little known dataset from the national Department of Health website and created the Medicine Price Registry Application (MPRApp), an online tool that allows patients to compare medicine prices. There is evidence that doctors use the information provided by MPRApp to save their patients money, however. MPR currently relies on the time and skills of its developer to be updated regularly. The continued use and impact of MPRApp remains uncertain unless sustainable funding can be secured. With no marketing or promotions to speak of, MPRApp has had an impact on the lives of a few South Africans; with a sustainable model and increased awareness of MPRApp, particularly among trusted intermediaries in the health sector, it can provide many more patients access to cheaper medicines.

Uganda: Opening Health Data to Improve Outcomes — In Uganda, open data initiatives are being used to help improve health outcomes and revolutionize a health care industry marred by staff shortages, lack of resources, and corruption. The Kampala-based organization Cipesa, for example, has collaborated with a local media organization, Numec, to create the iParticipate project, which analyzes and shares open government data with the aim to enable citizen empowerment. Part of this project is to develop and populate data concerning health care services by collating information sent via SMS by journalists, civil society, and the wider public. Similarly, the Women of Uganda Network (WOUGNET), which trains women to use information technology, created an online platform to collect and document information relating to poor health care services. This allowed Wougnet to lobby for the creation of a health clinic in Aloni parish, which is now under construction.

APPENDIX B

INPUT RECEIVED

INTERVIEWEES

Experts and stakeholders interviewed during the development of the 12 Open Data in Developing Economies Case Studies:

Bibhusan Bista, Young Innovations
Nama Raj Budhathoki, Kathmandu Living Labs,
Pranav Budhathoki, Local Interventions Group
Penhleak (Pinkie) Chan, Open Development Cambodia
Dr J. Cunningham, Doctor in the Public and Private Healthcare Sectors, South Africa
Aidan Eyakuze, Twaweza
Adi Eyal, Code for South Africa
Miryam Patricia Guzmán García, Fedearroz
Dr R. Henry, Doctor in the Public Healthcare Sector, South Africa
Elena Ignatova, BlueSquare, Belgium
Priya Jadhav, Assistant Professor, Indian Institute of Technology — Bombay
Daniel Jimenez, International Center for Tropical Agriculture (CIAT)
Vincent Kamenyero, Burundi
Verena Luise Knippel, World Bank
Swheta Kulkarni, Research Associate, Prayas Energy Group
Antoine Legrand, BlueSquare, Belgium
David Lemayian, Code for Africa
Anca Mantioc, The Engine Room
Michelle McLeod, Caribbean Open Institute / University of the West Indies
Maurice McNaughton, Caribbean Open Institute / University of the West Indies
Arnold Minde, Developer of Shule.info
Oscar Montiel, Open Knowledge International
Mulle Musau, Elections Observation Group (ELOG), Kenya
Ravi Kumar Nepal, World Bank, Code for Nepal
Dr. Etienne Nkeshimana, Burundi
Jean Claude Nshimirimana, Open RBF Programs, Ministry of Health, Burundi

Muchiri Nyaggah, Local Development Research Institute, Kenya

Juan Pane, National University of Asunción, Paraguay and Latin American Open Data Initiative

Esteban Peláez Gómez, Coordinator of Social Projects, Fundación Corona

Ashok Pendse, Authorised Consumer Representative with the Maharashtra Electricity Regulatory Commission (MERC)

Mor Rubinstein, Open Knowledge International

Priyadarshan Sahasrabuddhe, Vishwadeep Pressparts Pvt. Ltd

Fabrizio Scrollini, DATA Uruguay

Jennifer Shkbaktur, IDC Herzliya

Simone Soeters, Cordaid, The Netherlands

Thy Try, Open Development Cambodia

Daniel Uribe, Fundacion Corona

Samhir Vasdev, ICT Sector Unit, World Bank Group

Adele Waugaman, USAID

Christopher Whyms-Stone, Trench Town Culture Yard

OPEN DATA IN DEVELOPING ECONOMIES ADVISORY COMMITTEE

Izabela Corrêa, Former Coordinator for the Promotion of Ethics, Transparency, and Integrity, Directorate for Corruption Prevention, Brazil

Elena Ignatova, BlueSquare

André Laperrière, Executive Director, Global Open Data Initiative for Agriculture and Nutrition (GODAN)

Maurice McNaughton, Director of the Centre of Excellence for IT Enabled Innovation, Mona School of Business and Management, University of the West Indies, Jamaica

Jean Philbert Nsengimana, Minister of Youth and Information Communication Technology, Rwanda

David Selassie Opoku, Open Data for Development (OD4D) Africa Lead, Open Knowledge International

Fernando Perini, International Development Research Center, Canada

Nii Narku Quaynor, Chairman, Network Computer Systems, Ghana

Nicole Stremlau, Programme in Comparative Media Law and Policy, University of Oxford, UK

RECOGNIZED PEER REVIEWERS OF THE OPEN DATA IN DEVELOPING ECONOMIES CASE STUDIES AND DRAFT PAPER

Patrick Enaholo, Pan-Atlantic University, Nigeria

Sara Fernandes, University of Minho and United Nations University

Claudia Frittelli, Carnegie Corporation

Silvana Fumega, University of Tasmania, Institute for the Study of Social Change

Shurland George, World Wide Web Foundation

Felipe Gonzalez-Zapata, University of Manchester

Julina Hooks, Teachers College Columbia University

Alicia Johnson, San Francisco Emergency Management

Antonio Almansa Morales, Diputación Provincial Málaga (Málaga City County Council)

Freddy Oswaldo, Independent Consultant

Iris Palma, DatosElSalvador

Mohamed Salimi, HCP

Juliana Taylor, Start Smart

Julia Roberto Herrara Toledo, Red Ciudadana

Mariam Rafique Vadria, Delivery Associates

Christopher Wilson, University in Oslo

Ken Zita, Network Dynamics Associates

PARTICIPANTS TO WORKSHOP AT THE INTERNATIONAL OPEN DATA CONFERENCE IN MADRID, SPAIN (WEDNESDAY, OCTOBER 5, 2016) ON "GETTING TO GRIPS WITH THE IMPACT OF OPEN DATA" (THE OPEN DATA IN DEVELOPING ECONOMIES PROJECT)

Facilitator: Stefaan Verhulst, The GovLab

Participants:

Laura Bacon, Omidyar Network
Mark Cardwell, USAID
Patrick Enaholo, Pan-Atlantic University, Nigeria
Adi Eyal, Code for South Africa
Feng Gao, Open Data China
Silvana Fumega, University of Tasmania, Institute for the Study of Social Change
Mohammad Hossein Ichani, Open Data for Iran
Michael Jelenic, World Bank
Michelle McLeod, University of the West Indies
Maurice McNaughton, University of the West Indies
Indanna Minto-Coy, University of the West Indies
Jean Claude Nshimirimana, Ministry of Health, Burundi
David S. Opoku, Africa Lead, Open Data for Development, Open Knowledge International
Juan Pane, National University of Asunción, Paraguay and Latin American Open Data Initiative
Alán Ponce, University of Southampton
Brandon Pustejovsky, USAID
Lorna Seitz, Legis Institute
Tanya Sethi, AidData
Ilham C. Srimarga, University of the Western Cape
Kat Townsend, MCC
Mireille van Eechoud, University of Amsterdam
Roza Vasileva, World Bank
Julian Walcott, University of the West Indies
Natalie Widmann, Max Planck Institute for Intelligent Systems

APPENDIX C

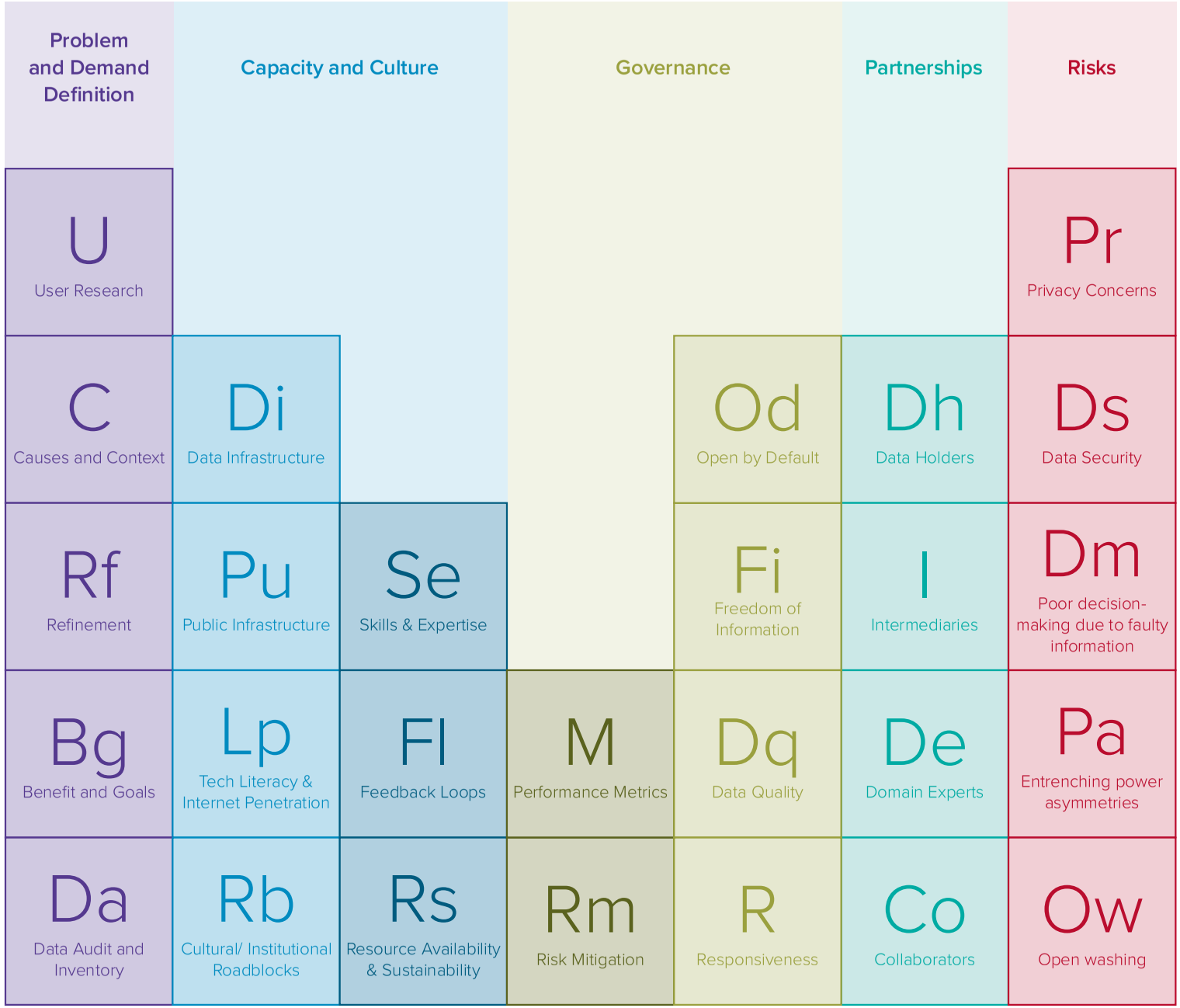
PERIODIC TABLE OF OPEN DATA IMPACT ELEMENTS

What determines the impact of open data? Based upon extensive research we identified 27 factors or elements, along five categories, that are important when developing or reviewing open data initiatives. Taken together they provide a checklist for data providers, data users, donors, and others to consider.

> *No single element can guarantee success but having several in place across the five categories, and working together, increases the likelihood of impact. Similarly, it is unlikely that a single open data project will include every single component described here — these elements can be combined (i.e., bonded) in a way that creates a favorable impact.*

Clint Adair - Unsplash

ELEMENTS WORK TOGETHER



PROBLEM AND DEMAND DEFINITION

Particularly in developing economies, where resources to put toward data release or data use can be in short supply, a clear, detailed understanding of the problem to be addressed by open data can help to ensure that efforts are targeted and optimized. Some of the most effective open data projects examined here are laser-focused on a specific user group (e.g., smallholder farmers in Colombia or Ghana), or identified gap (e.g., the lack of power quality in the Indian energy sector). Clearly defining the problem can also aid in the development of metrics of success and a strategy for monitoring progress against a well-defined baseline. Many of the initiatives studied as part of this project lacked such a monitoring strategy, making assessments of impact, evidence-driven iteration, and the demonstration of return on investment more challenging.

U
User Research

Open data initiatives tend to be more successful and avoid the notion of, "if you build it, will they come," when they are clearly optimized for an intended audience or user base from the start. The upfront identification, mapping and understanding of relevant constituencies, and a similar examination of their needs can enable more targeted open data-driven interventions.

C
Causes and Context

In many open data initiatives, and in governance innovation efforts more generally, practitioners can find themselves addressing symptoms rather than the root causes of problems. Open data projects, such as the effort to predict dengue outbreaks in Paraguay, tend to be more successful when they seek to address underlying problems (mosquito breeding and transmission) rather than the symptoms of those problems (high levels of dengue fever).

Rf
Refinement

To move from a well-understood problem area, to a granular, actionable, and quantifiable path forward, successful practitioners often look to refine their understanding of the problem to be addressed by seeking to understand, for instance, *why* the problem exists in its current form, what contributing factors could be at play, what potential knock-on effects of addressing the problem might be, and why the problem has not yet been solved by some other interested party.

Bg
Benefit and Goals

Open data projects often fail to build an audience or continue to evolve and expand successfully over time if they do not successfully define the intended benefits of the open data use and set clear target goals. These deficiencies often can create difficulty in the development of metrics and indicators — important drivers of iteration and impact.

Many of the projects studied, including notably Kenya's GotToVote! project did not have a clear baseline against which to measure the success of the project. Without an understanding of the current baseline, measuring progress toward identified goals and demonstrating whether and how open data efforts actually benefited the public remains a challenge.

Da
Data Audit and Inventory

Once the problem and value proposition are in place, practitioners are able to explore the availability of datasets**,** both in the form of open government data, and from other potentially useful and relevant data sources, like NGOs, the private sector, or crowdsourcing efforts. A clear problem definition can help to uncover which data sources could add value and inform strategies for collecting or accessing that data. Colombia's Aclímate Colombia, for instance, identified the types of data it needed for its agriculture algorithms and engaged the semi-public industry groups that had it. The Prayas Energy Group in India, on the other hand, found that no one collected or stored the type of energy usage information it needed for its power quality monitoring efforts, so it launched its own (open) data collection effort across 18 Indian states.

PARTNERSHIPS

In many high-impact open data projects, partnerships within and especially across sectors play a key role in enabling success. Whether creating touchpoints with citizens through partnerships with civil society, informing the public through media partnerships, or filling important data gaps through partnerships with private sector entities, open data suppliers and users often improve outcomes through collaboration.

Dh
Data Holders

Although open data is meant to provide value to data users without any direct engagement with data holders necessary, partnering with entities on the supply side (including government) can help to fill data gaps and enable higher impact data use.

Aclímate Colombia is a strong example of the potential of such partnerships. The initiative, aimed at providing farmers with a better ability to plant crops in a way that is resilient to changes in climate, would not be possible without collaboration between the driver of the initiative (a civil society organization), key data holders (government ministries and agencies), and a second group of key data holders (private and semi-private crop growers' associations). GotToVote! in Kenya, on the other hand, did not establish such cross-sector partnerships, and its long-term sustainability is now in question.

I
Intermediaries

In many developing economies, as mentioned above, Internet penetration and, especially, data literacy are low among the citizenry. The presence of intermediaries — including journalists and others with relevant skills — can help to determine whether or not the available open data-driven outputs reach a community of users, and the intended impact is achieved.[49] The continued advancement of open data intermediaries can be seen as a key area of capacity building in developing economies.

To encourage the use of Code for South Africa's MPRApp, doctors and pharmacists played an important intermediation role with citizens. These trusted advisors — with nothing to gain from helping patients spend less money on their prescriptions — helped to alert citizens to the database and the potential for identifying much cheaper generic drugs to treat their ailments.

In addition, the open data-driven offerings of Open Development Cambodia are often presented on the initiative's website in a comprehensible manner (similar to data-driven Wikipedia articles on topics of public concern, like forest cover or development aid spending), but reach a much wider audience when taken up by journalists in the country and abroad in reporting on conditions in the country.

Both of Tanzania's open education dashboards, on the other hand, failed to attract a regular user base, likely as a result of a failure to engage consistently with intermediaries that could make the sites' offerings useful to an intended audience with low digital literacy and access.

De
Domain Experts

In many cases, demand-side open data actors' expertise lies in technology or data science rather than the problem areas they seek to address through the use of open data. Tapping into the knowledge of stakeholders with relevant sector-specific expertise can improve efforts to optimize and target open data efforts based on a true understanding of needs, opportunities, and barriers. Nepali NGOs and businesses using open government data and crowdsourced data during the response to a major earthquake in the country, for instance, engaged with on-the-ground experts in crisis response who came to Nepal from around the world to help target its offerings.

Co
Collaborators

Open data practitioners can extend their capacity by collaborating with like-minded organizations, institutions, or individuals, including foreign actors. Ghana's Esoko agricultural information service, for example, is part of the Global Open Data for Agriculture and Nutrition (GODAN) network, enabling the company to tap into the knowledge of similar organizations from around the world seeking to leverage open agriculture data for business development and/or public benefit.

RISKS

The release and use of open data in developing economies are not without risks. An upfront mapping and consideration of risks associated with intended uses of open data can allow practitioners to design programs from the outset in a way that is well-positioned to overcome or mitigate those risks. The risks listed here, however, should not be considered arguments against using open data in development. Rather, they are reasons for taking a more fine-grained approach that pays close attention to the empirical evidence, sifting out what works and what does not, and identifying conditions for scaling and replication.

Pr
Privacy Concerns

Privacy concerns probably rank among the most commonly cited worries over opening up data. Especially in conflict-stricken regions, individuals' anonymity can be of life-or-death importance. Potential privacy harms can arise even from the release of ostensibly anonymized personally identifiable information (PII).[50] Although the vast majority of open data efforts seek to anonymize or otherwise limit the release of PII, it is important to recognize that a lack of sophistication in anonymization or aggregation efforts can result in the inadvertent release of sensitive information.[51] In addition, in some instances information that itself poses no privacy concerns can be combined with other openly available datasets; the aggregated and linked information can lead to unexpected disclosure of personal data, such as bringing together open data on political activities with separately accessible information on a person's location or place of work, for example.[52]

Ds
Data Security

Because much government data contains sensitive information regarding individuals, industries, and national security, opening that data often leads to quite reasonable questions about data security. Cybersecurity remains a challenge across the world, and perhaps especially so in developing countries, which may lack the technical expertise to adequately protect information from sophisticated hackers and other intrusions.[53] At the same time, though security concerns are very real and important, they must be balanced against the opportunity cost or risk of not sharing data; often, government decision makers can lean on tenuous security concerns to justify keeping data closed and restricting access, potentially limiting the solution space.

Dm
Poor decision-making due to faulty information

Whether related to humanitarian efforts, crisis relief, or the livelihoods of vulnerable populations, data-driven efforts in developing economies can be literally life-or-death affairs. Given the many challenges and obstacles involved in open data projects, it is important to recognize the risks inherent in basing such life-and-death decisions on information that could be incomplete, out-of-date or otherwise faulty. The broader point is this: insights generated from data are only as good — and their impacts only as positive — as the quality of the underlying data.[54]

Pa
Entrenching power asymmetries

Although data can be empowering, it can also consolidate or reinforce existing privileges and authority inherent in societies. This problem is closely linked (though not restricted) to digital divide challenges; when only the elite of a society have access to data and/or data science capabilities, releasing data is likely to disproportionally benefit that elite.[55] We found numerous examples,[56] and they are important reminders that open data projects need to work hard to ensure that their social and economic benefits are widely, and evenly, distributed.

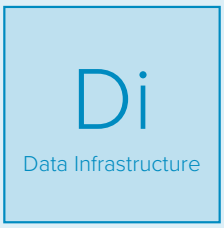
Ow
Open washing

The term *"open washing"* has taken hold in practitioner circles over recent years describing the risk that governments may seek to leverage the enthusiasm for open data to avoid more difficult and potentially transformative openness and transparency efforts.[57] The Extractives Industries Transparency Initiative, for instance, is a laudable effort to push for more energy-related openness around the world, which has had demonstrable impacts on accountability. There is a growing belief, however, that a subset of still largely closed governments is joining the initiative only "in order to increase their international reputation and bolster their access to foreign aid."[58]

CAPACITY AND CULTURE

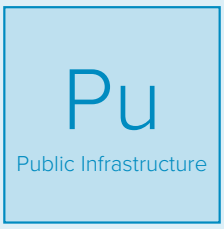
The lack of available resources, insufficient human capital and immature technological capabilities can create major challenges to achieving meaningful impact with open data projects. These challenges can exist both within a country's open data ecosystem — that is, the capacity of government, civil society, tech community, and the general public — as well as within the actors on the demand side using open data toward certain objectives and the donor organizations funding them.

OPEN DATA ECOSYSTEM ELEMENTS



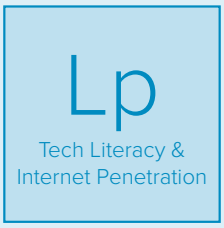
On the supply side of open data the lack of a strong data infrastructure — that is, hardware and software platforms to make data consistently accessible and machine-readable in a timely manner — often creates major challenges to positive impact.

Burundi's OpenRBF platform is an example of working around issues related to data infrastructure. Burundi provided access to data on its results-based financing efforts around healthcare through the OpenRBF platform, a digital infrastructure for collecting and publishing such data. The existence of an "out-of-the-box" tool for making results-based funding (RBF) data public in reusable formats catalyzed the widespread opening of RBF data across many developing countries in Africa.



Similar to the ICT4D environment, much of the literature and practice[48] of open data in developing economies points to the importance of a strong public infrastructure — human capital (including data science and statistical knowledge), public services (including education and libraries), and civil society — to ensure that data is collected, cleaned, and released in a usable manner and that updates and feedback are seamlessly incorporated into open datasets. Supply side efforts to leverage these public infrastructures can increase the demand for open data and establish touchpoints with users.

An active ecosystem of data users and international open mapping platforms and individuals helped to ensure that Nepal's open data-driven crisis response efforts could be quickly developed and put into practice. The challenges experienced by Ghana's Esoko platform as a result of unreliable electricity access in the country, on the other hand, shows the many ways that public infrastructure can affect the success of open data projects.



Even as access to the Internet continues to expand across the developing world, especially through smartphones and other portable devices, many open data projects are being launched into communities that suffer from low Internet penetration and a persistent digital divide. Several of the initiatives studied struggled to achieve their transformative potential, particularly when practitioners failed to engage intermediaries or civil society groups capable of reaching unconnected audiences.

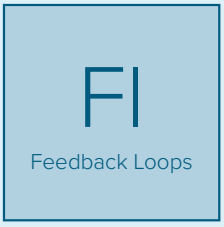
Stakeholders involved in South Africa's Medicine Price Registry Application (MPRApp) and Tanzania's open education dashboards pointed to low Internet penetration rates, and the related challenge of low tech literacy, as major barriers they confronted to achieving greater positive impacts.

As is often the case in developed countries, too, cultural and institutional roadblocks can limit the impact of open data. These roadblocks can manifest in the form of an institutional culture that remains skeptical of openness, or the absence of well-trained individuals and professionals capable of recognizing and acting on the potential of open data (readiness) — beyond the prevalence of engaging volunteers in the development of open data initiatives. In all cases, a more concerted culture- and capacity-building effort is often necessary to create an impact.

In Burundi, for instance, efforts to create transparency and accountability around its results-based financing efforts were slowed and complicated by a lack of readiness for technology-enabled openness within key institutions. Jamaica's open data tourism efforts relied on the readiness of outside volunteers to supplement open data through crowdsourcing — with the impact of the project dependent on their capacity to collect data and information in a strategic, usable manner.

OPEN DATA USER/DONOR ELEMENTS

Especially for more technical uses of open data — such as sophisticated data analytics — actors on the demand side of open data need to possess certain skills and expertise. Employees at CIAT, the organization behind Aclímate Colombia, for instance, possess high-level data science capabilities that enabled them to leverage open data to create sophisticated algorithmic tools to inform agricultural decision making. Other projects, like crowdsourcing efforts from Jamaica and Nepal, relied on the skills of a few important institutional actors on the demand side and the less-technical efforts of volunteer data collectors.



Open data initiatives tend to be less successful when they do not create mechanisms for users and beneficiaries to provide input to demand-side practitioners. Tanzania's open education dashboards are a notable example. The platforms were launched into an environment with low Internet penetration and digital literacy, with seemingly little opportunity for the intended users and beneficiaries of the tools, like parents or education advocates, to suggest ways to make the platforms more usable (and useful) for the community.

The availability of funding and resources are a key variable of success on both the supply and demand sides of open data. Focusing on the demand side, although many open data projects can be stood up quickly on a tight budget (such as Kenya's GotToVote! an initial prototype of which was created for only $500), sometimes with a very small team (Paraguay's dengue prediction efforts were championed by researcher Juan Pane and a small team under his direction), establishing sustainability and scaling use often requires more sustained funding and/or well-defined business models. This was the dynamic at work for example in South Africa, where the MPRApp relied almost entirely on the time and effort of a single person. Likewise, in Uganda, CIPESA, the developers of the iParticipate open health data and citizen engagement effort, struggled to proactively elevate health service delivery concerns to relevant government officials because of funding issues affecting both data collection and outreach efforts.

The agriculture information tool Esoko, on the other hand, has managed to take hold in Ghana in large part due to its for-profit, largely business to business (B2B) model, as well as significant investments from foundations and international organizations.

GOVERNANCE

A diversity of governing decisions affect the use and impact of open data efforts. Issues of governance exist at both the ecosystem level — especially related to standards and policies of data release — and on the demand side, with questions of risk mitigation and impact assessment leading the way.

OPEN DATA ECOSYSTEM ELEMENTS

Od
Open by Default

Given the level of government resource allocation and time investment required to implement strong open data initiatives, high-level political buy-in and codified open data policies (reflecting the International Open Data Charter principles)[59] are needed to provide the incentives and flexibility to government officials to meaningfully advance open data goals.

The ESMI effort in India, for example, is an industry- and NGO-driven effort to create and open useful data on power quality in the country. This effort, which has had relatively little discernible impact to date, is only necessary because of the lack of energy data being opened by government — an issue that could be resolved with a commitment to openness by default and other internationally accepted principles.

Fi
Freedom of Information

Clear policies pushing forward access to information and data can act as important drivers for open data initiatives. Without explicit policy backing, the sustainability of open data efforts can be called into question, and access to necessary data can dry up at any time. The existence of Freedom of Information policies can also provide means for accessing relevant information, though often at a much slower pace than open data.

A key enabler for the MPRApp open data initiative, for example, was South Africa's legislative framework that promotes and enacts transparency in medicine pricing. Such a framework compels the Department of Health to collect and publish data on medicine prices in South Africa, ensuring that the supply side of the MPRApp will continue to be made accessible, allowing Code for South Africa to focus on improving the tool and getting it into the hands of its intended users.

Dq
Data Quality

A widely prevalent challenge to positive impact arises from poor data quality. Data quality is an issue in developed countries, but often presents even greater barriers to success in developing countries. Quality issues can manifest in a number of ways, like inaccurate information, a lack of completeness in official datasets, out-of-date data, or otherwise corrupted datasets.

Aclímate Colombia, for example, experienced challenges gaining access to the most complete and up-to-date information sets for its agriculture tools, slowing their development. Open Development Cambodia's efforts are consistently challenged by not only strong restrictions in terms redistribution, reproduction, and reuse on some datasets, but also by the inconsistency and unpredictability of when updates to important official datasets occur.

In South Africa, the MPRApp was hurt by a lack of interoperability; that is, open data was not made available in standards that allowed for aggregation and manipulation. Likewise, Kenya's GotToVote! experienced major challenges when one of its central data sources crashed unexpectedly, rendering the platform temporarily unusable.

R
Responsiveness

Just as open data is unlikely to create a major impact without demand-side actors to act upon released data, a lack of responsiveness, often characterized by a lack of commitment to take up data-driven insights within governing institutions, can limit the impact of open data. Often, governments succumb to the temptation to open wash data, nominally opening it up but failing to create feedback loops to ensure that users are actually using the data or that data is being released to meet a genuine demand.

In Jamaica, for example, an interactive community mapping project is supplementing open datasets with a crowdsourced effort to improve tourism in the country; the project's clear potential has not yielded major impacts yet in part because tourism authorities have not yet acted on the generated insights. The researchers who used open data to predict dengue fever transmission in Paraguay also experienced ongoing challenges wresting the most useful data for their algorithms from government data holders; there has been little indication that their insights will be meaningfully taken up by institutional authorities.

OPEN DATA USER/DONOR AGENCY ELEMENTS

M
Performance Metrics

Open data projects are better positioned for success when practitioners develop and monitor metrics of impact to inform management and iteration.

The vast majority of the open data initiatives studied in this series lacked clearly defined performance metrics. Not only does this create major challenges for iterating upon early efforts, it calls the sustainability of these interventions into question, with a demonstration of success and impact a likely requirement for continued funding and investment.

Rm
Risk Mitigation

In some cases, open data projects can be advanced despite some level of risk. In such cases, practitioners must ensure that projects that deal in information that is potentially personally identifiable (including anonymized data) have outlined and implemented a clear, upfront strategy for addressing risks created by open data use.

Many of the projects studied in this series dealt in potentially sensitive information—e.g., health, energy consumption, political, and education data. Although each project took steps to ensure that no personally identifiable information was released to the public, all would benefit from a clearly defined—and, preferably, openly available—risk mitigation strategy to ensure that no harms inadvertently fall on data subjects.

APPENDIX D

SELECTED READINGS ON OPEN DATA IN DEVELOPING ECONOMIES

OPEN DATA AND OPEN GOVERNMENT FOR DEVELOPMENT

Benjamin, Solomon, R. Bhuvaneswari, P. Rajan and Manjunatha, "Bhoomi: 'E-governance,' or, an anti-politics machine necessary to globalize Bangalore?" CASUM-m Working Paper, January 2007, http://bit.ly/2aD3vZe**.**

- This paper explores the digitization of land titles and their effect on governance in Bangalore. The paper takes a critical view of digitization and transparency efforts, particularly as best practices that should be replicated in many contexts.
- The authors point to the potential of centralized open data and land records databases as a means for further entrenching existing power structures. They found that the digitization of land records in Bangalore "led to increased corruption, much more bribes and substantially increased time taken for land transactions," as well allowing "very large players in the land markets to capture vast quantities of land when Bangalore experiences a boom in the land market."
- They argue for the need "to replace politically neutered concepts like 'transparency', 'efficiency', 'governance', and 'best practice' [with] conceptually more rigorous terms that reflect the uneven terrain of power and control that governance embodies."

McGee, Rosie and Duncan Edwards, "Introduction: Opening Governance — Change, Continuity and Conceptual Ambiguity," IDS Bulletin, January 24, 2016. http://bit.ly/2aJn1pq**.**

This introduction to a special issue of the *IDS Bulletin* frames the research and practice of leveraging opening governance as part of a development agenda.

The piece primarily focuses on a number of "critical debates" that "have begun to lay bare how imprecise and overblown the expectations are in the transparency, accountability and openness 'buzzfield', and the problems this poses."

A key finding on opening governance's uptake and impact in the development space relates to political buy-in:

"Political will is generally a necessary but insufficient condition for governance processes and relationships to become more open, and is certainly a necessary but insufficient condition for tech-based approaches to open them up. In short, where there is a will, tech-for-T&A may be able to provide a way; where there isn't a will, it won't."

OPEN DATA AND DATA 4 DEVELOPMENT

3rd International Open Data Conference (IODC), "Enabling the Data Revolution: An international open data roadmap," Conference Report, 2015, http://bit.ly/2asb2ei.

This report, prepared by Open Data for Development, summarizes the proceedings of the third IODC in Ottawa, ON. It sets out an action plan for "harnessing open data for sustainable development," with the following five priorities:

1. Deliver shared principles for open data
2. Develop and adopt good practices and open standards for data publication
3. Build capacity to produce and use open data effectively
4. Strengthen open data innovation networks
5. Adopt common measurement and evaluation tools

The report draws on 70 impact accounts to present cross-sector evidence of "the promise and reality of open data," and emphasizes the utility of open data in monitoring development goals, and the importance of "joined-up open data infrastructures," ensuring wide accessibility, and grounding measurement in a clear understanding of citizen need, in order to realize the greatest benefits from open data.

Finally, the report sets out a draft International Open Data Charter and Action Plan for International Collaboration.

Hilbert, Martin, "Big Data for Development: A review of promises and challenges," Development Policy Review, December 13, 2015, http://bit.ly/2aoPtxL**.**

This article presents a conceptual framework based on the analysis of 180 articles on the opportunities and threats of big data for international development.

Open data, Hilbert argues, can be an incentive for those outside of government to leverage big data analytics: "If data from the public sector were to be openly available, around a quarter of existing data resources could be liberated for Big Data Analytics."

Hilbert explores the misalignment between "the level of economic well-being and perceived transparency of a country" and the existence of an overarching open data policy. He points to low-income countries that are active in the open data effort, like Kenya, Russia and Brazil, in comparison to "other countries with traditionally high perceived transparency," which are less active in releasing data, like Chile, Belgium and Sweden.

International Development Research Centre, World Wide Web Foundation, and Berkman Center at Harvard University, "Fostering a Critical Development Perspective on Open Government Data," Workshop Report, 2012, http://bit.ly/2aJpyQq**.**

This paper considers the need for a critical perspective on whether the expectations raised by open data programs worldwide — as "a suitable remedy for challenges of good governance, economic growth, social inclusion, innovation, and participation" — have been met, and if so, under what circumstances.

Given the lack of empirical evidence underlying the implementation of open data initiatives to guide practice and policy formulation, particularly in developing economies, the paper discusses the implementation of a policy-oriented research agenda to ensure open data initiatives in the Global South "challenge democratic deficits, create economic value and foster inclusion."

The report considers theories of the relationship between open data and impact, and the mediating factors affecting whether that impact is achieved. It takes a broad view of impact, including both demand- and supply-side economic impacts, social and environmental impact, and political impact.

Open Data for Development, "Open Data for Development: Building an inclusive data revolution," Annual Report, 2015, http://bit.ly/2aGbkz5**.**

This report — the inaugural annual report for the Open Data for Development program — gives an overview of outcomes from the program for each of OD4D's five program objectives:

1. Setting a global open data for sustainable development agenda;
2. Supporting governments in their open data initiatives;
3. Scaling data solutions for sustainable development;
4. Monitoring the availability, use and impact of open data around the world; and
5. Building the institutional capacity and long-term sustainability of the Open Data for Development network.

The report identifies four barriers to impact in developing countries: the lack of capacity and leadership; the lack of evidence of what works; the lack of coordination between actors; and the lack of quality data.

Stuart, Elizabeth, Emma Samman, William Avis and Tom Berliner, "The Data Revolution: Finding the missing millions," Open Data Institute Research Report, April 2015, http://bit.ly/2acnZtE**.**

This report examines the challenge of implementing successful development initiatives when many citizens are not known to their governments as they do not exist in official databases.

The authors argue that "good quality, relevant, accessible and timely data will allow willing governments to extend services into communities which until now have been blank spaces in planning processes, and to implement policies more efficiently."

In addition to improvements to national statistical offices, the authors argue that "making better use of the data we already have" by increasing openness to certain datasets held by governments and international organizations could help to improve the situation.

They examine a number of open data efforts in developing countries, including Kenya and Mexico.

Finally, they argue that "the data revolution could play a role in changing the power dynamic between citizens, governments and the private sector, building on open data and freedom of information movements around the world. It has the potential to enable people to produce, access and understand information about their lives and to use this information to make changes."

United Nations Independent Expert Advisory Group on a Data Revolution for Sustainable Development, "A World That Counts, Mobilizing the Data Revolution," 2014, http://bit.ly/2am5K28**.**

This report focuses on the potential benefits and risks data holds for sustainable development. Included in this is a strategic framework for using and managing data for humanitarian purposes. It describes a need for a multinational consensus to be developed to ensure data is shared effectively and efficiently.

It suggests that "people who are counted" — i.e., those who are included in data collection processes — have better development outcomes and a better chance for humanitarian response in emergency or conflict situations.

In particular, "better and more open data" is described as having the potential to "save money and create economic, social and environmental value" toward sustainable development ends.

The World Bank, Digital Dividends: World Development Report 2016, http://bit.ly/2aG9Kx5**.**

This report examines "digital dividends" or the development benefits of using digital technologies in the space.

The authors argue that: "To get the most out of the digital revolution, countries also need to work on the 'analog complements' — by strengthening regulations that ensure competition among businesses, by adapting workers' skills to the demands of the new economy, and by ensuring that institutions are accountable."

The "data revolution," which includes both big data and open data is listed as one of four "digital enablers."

Open data's impacts are explored across a number of cases and developing countries and regions, including: Nepal, Mexico, Southern Africa, Kenya, Moldova, and the Philippines.

Despite a number of success stories, the authors argue that: "sustained, impactful, scaled-up examples of big and open data in the developing world are still relatively rare," and, in particular, "Open data has far to go." They point to the high correlation between readiness, implementation and impact of open data to GDP per capita as evidence of the room for improvement.

OPEN DATA AND OPEN DEVELOPMENT

Reilly, Katherine and Juan P. Alperin, "Intermediation in Open Development: A knowledge stewardship approach," Global Media Journal (Canadian Edition), 2016, http://bit.ly/2atWyI8**.**

This paper examines the intermediaries that "have emerged to facilitate open data and related knowledge production activities in development processes."

In particular, they study the concept of "knowledge stewardship," which "demands careful consideration of how — through what arrangements — open resources can best be provided, and how best to maximize the quality, sustainability, buy-in, and uptake of those resources."

The authors describe five models of open data intermediation:

- Decentralized
- Arterial
- Ecosystem
- Bridging
- Communities of practice

Reilly, Katherine and Rob McMahon, "Quality of Openness: Evaluating the contributions of IDRC's Information and Networks Program to open development," International Development Research Centre, January 2015, http://bit.ly/2aD6hoU.

This report describes the outcomes of IDRC's Information and Networks (I&N) program, focusing, in particular, on those related to "quality of openness" of initiatives as well as their outcomes.

The research program explores "mechanisms that link open initiatives to human activities in ways that generate social innovations of significance to development. These include push factors such as data holders' understanding of data usage, the preparedness or acceptance of user communities, institutional policies, and wider policies and regulations; as well as pull factors including the awareness, capacity and attitude of users. In other words, openly networked social processes rely on not just quality openness, but also on supportive environments that link open resources and the people who might leverage them to create improvements, whether in governance, education or knowledge production."

Smith, M. and L. Elder, "Open ICT Ecosystems Transforming the Developing World," Information Technologies and International Development, 2010, http://bit.ly/2au0qsW**.**

The paper examines the hypothesis that "open social arrangements, enabled by ICTs, can help to catalyze the development impacts of ICTs. In other words, open ICT ecosystems provide the space for the amplification and transformation of social activities that can be powerful drivers of development."

Although the focus is placed on a number of ICT interventions — with open data only directly referenced as it relates to the science community — the lessons learned and overarching framework are applicable to the open data for development space.

The authors argue for a new research focus on "the new social activities enabled by different configurations of ICT ecosystems and their connections with particular social outcomes." They point in particular to "modules of social practices that can be applied to solve similar problems across different development domains," including "massive participation, collaborative production of content, collaborative innovation, collective information validation, new 'open' organizational models, and standards and knowledge transfer."

Smith, Matthew and Katherine M. A. Reilly, eds., Open Development: Networked innovations in international development, MIT Press, 2013, http://bit.ly/2atX2hu**.**

This edited volume considers the implications of the emergence of open networked models predicated on digital network technologies for development. In their introduction, the editors emphasize that openness is a means to support development, not an end, which is layered upon existing technological and social structures. Though openness is often disruptive, it depends upon some measure of closedness and structure to function effectively.

Subsequent, separately authored chapters provide case studies of open development drawn from health, biotechnology, and education, and explore some of the political and structural barriers faced by open models.

van den Broek, Tijs, Marijn Rijken and Sander van Oort, "Towards Open Development Data: A review of open development data from a NGO perspective," 2012, http://bit.ly/2ap5E8a**.**

In this paper, the authors seek to answer the question: "What is the status, potential and required next steps of open development data from the perspective of the NGOs?"

They argue that "the take-up of open development data by NGOs has shown limited progress in the last few years," and offer "several steps to be taken before implementation" to increase the effectiveness of open data's use by NGOs to improve development efforts:

- Develop a vision on open development and open data.
- Develop a clear business case.
- Research the benefits and risks of open development data and raise organizational and political awareness and support.
- Develop an appealing business model for data intermediaries and end-users.
- Balance data quality and timeliness.
- Dealing with the data obesity.
- Enrich quantitative data to overcome a quantitative bias.
- Monitor implementation and share best practices.

OPEN DATA AND DEVELOPMENT GOALS

Berdou, Evangelia, "Mediating Voices and Communicating Realities: Using information crowdsourcing tools, open data initiatives and digital media to support and protect the vulnerable and marginalised," Institute of Development Studies, 2011, http://bit.ly/2aqbycg**.**

This report examines how "open source information crowdsourcing platforms like Ushahidi, and open mapping and data initiatives like OpenStreetMap, are enabling citizens in developing countries to generate and disseminate information critical for their lives and livelihoods."

The authors focus in particular on:

- "the role of the open source social entrepreneur as a new development actor
- the complexity of the architectures of participation supported by these platforms and the need to consider them in relation to the decision-making processes that they aim to support and the roles in which they cast citizens
- the possibilities for cross-fertilisation of ideas and the development of new practices between development practitioners and technology actors committed to working with communities to improve lives and livelihoods."

While the use of ICTs and open data pose numerous potential benefits for supporting and protecting the vulnerable and marginalized, the authors call for greater attention to:

- challenges emerging from efforts to sustain participation and govern the new information commons in under-resourced and politically contested spaces
- complications and risks emerging from the desire to share information freely in such contexts
- gaps between information provision, transparency and accountability, and the slow materialization of projects' wider social benefits

Canares, Michael and Satyarupa Shekhar, "Open Data and Sub-national Governments: Lessons from developing countries," 2015, http://bit.ly/2au2gu2**.**

This synthesis paper seeks to gain a greater understanding of open data's effects on local contexts — "where data is collected and stored, where there is strong feasibility that data will be published, and where data can generate the most use and impact" — through the examination of nine papers developed as part of the Open Data in Developing Countries research project.

The authors point to three central findings:

- "There is substantial effort on the part of sub-national governments to proactively disclose data, however, the design delimits citizen participation, and eventually, use."
- Context demands different roles for intermediaries and different types of initiatives to create an enabling environment for open data."
- "Data quality will remain a critical challenge for sub-national governments in developing countries and it will temper potential impact that open data will be able to generate."

Davies, Tim, "Open Data in Developing Countries — Emerging Insights from Phase I," ODDC, 2014, http://bit.ly/2aX55UW**.**

This report synthesizes findings from the Exploring the Emerging Impacts of Open Data in Developing Countries (ODDC) research network and its study of open data initiatives in 13 countries.

Davies provides 15 initial insights across the supply, mediation, and use of open data, including:

- Open data initiatives can create new spaces for civil society to pursue government accountability and effectiveness;
- Intermediaries are vital to both the supply and the use of open data; and
- Digital divides create data divides in both the supply and use of data.

Davies, Tim and Duncan Edwards, "Emerging Implications of Open and Linked Data for Knowledge Sharing Development," IDS Bulletin, 2012, http://bit.ly/2aLKFyI**.**

This article explores "issues that development sector knowledge intermediaries may need to engage with to ensure the socio-technical innovations of open and linked data work in the interests of greater diversity and better development practice."

The authors explore a number of case studies where open and linked data was used in a development context, including:

- Open research: IDS and R4D meta-data
- Open aid: International Aid Transparency Initiative
- Open linked statistics: Young Lives

Based on lessons learned from these cases, the authors argue that "openness must serve the interests of marginalized and poor people. This is pertinent at three levels:

- Practices in the publication and communication of data
- Capacities for, and approaches to, the use of data
- Development and emergent structuring of open data ecosystems

Montano, Elise and Diogo Silva, "Exploring the Emerging Impacts of Open Data in Developing Countries (ODDC): ODDC1 follow-up outcome evaluation report," ODDC, 2016, http://bit.ly/2au65z7**.**

This report summarizes the findings of a two and a half year research-driven project sponsored by the World Wide Web Foundation to explore how open data improves governance in developing countries, and build capacity in these countries to engage with open data. The research was conducted through 17 subgrants to partners from 12 countries.

Upon evaluation in 2014, partners reported increased capacity and expertise in dealing with open data; empowerment in influencing local and regional open data trends, particularly among CSOs; and increased understanding of open data among policy makers with whom the partners were in contact.

Davies, Tim, Fernando Perini, and Jose Alonso, "Researching the Emerging Impacts of Open Data," ODDC, 2013, http://bit.ly/2aqb6uP**.**

This research report offers a conceptual framework for open data, with a particular focus on open data in developing countries.

The conceptual framework comprises three central elements:

- Open Data
- About government
- About companies and markets
- About citizens
- Domains of governance
- Political domains
- Economic domains
- Social domains
- Emerging Outcomes
- Transparency and accountability
- Innovation and economic growth
- Inclusion and empowerment

The authors describe three central theories of change related to open data's impacts:

- Open data will bring about greater transparency in government, which in turn brings about greater accountability of key actors to make decisions and apply rules in the public interest;
- Open data will enable non-state innovators to improve public services or build innovative products and services with social and economic value; open data will shift certain decision making from the state into the market, making it more efficient;
- Open data will remove power imbalances that resulted from asymmetric information, and will bring new stakeholders into policy debates, giving marginalized groups a greater say in the creation and application of rules and policy.

Open Data in Europe and Central Asia, "The Role of Open Data for Sustainable Development: A brief from Eastern Europe and Central Asia," 2016, http://bit.ly/2tiTgli

This report was produced by ODECA in partnership with the United Nations Development Programme and the Open Data for Development Network to assess the use and impact of open data in the Eastern European and Central Asia (EECA) region in the context of the SDGs.

Focusing their study in particular on Albania, Georgia and Moldova, the authors provide four central recommendations to increase open data's impact on development across the region:

- "Open data initiatives need to combine institutional and civil society development.
- Governments need to actively engage civil society actors when developing open data initiatives, creating higher awareness of open data, and using available capacity and synergies between sectors.
- Open data publication should be incorporated as a part of general civil service reforms, involving data literacy and increased awareness within the public sector.
- International organizations should provide vital support for open data within the EECA region, including necessary expertise in the field."

The World Bank, "Open Data for Sustainable Development," Policy Note, August 2015, http://bit.ly/2aGjaJ4**.**

This report from the World Bank seeks to describe open data's potential for achieving the Sustainable Development Goals, and makes a number of recommendations toward that end.

The authors describe four key benefits of open data use for developing countries:

- Foster economic growth and job creation
- Improve efficiency, effectiveness, and coverage of public services
- Increase transparency, accountability, and citizen participation
- Facilitate better information sharing within government
- The paper concludes with a number of recommendations for improving open data programs, including:
- Support open data use through legal and licensing frameworks.
- Make data available for free online.
- Publish data inventories for the government's data resources.
- Create feedback channels to government from current and potential data users.
- Prioritize the datasets that users want.

Smith, Fiona, William Gerry and Emma Truswell, "Supporting Sustainable Development with Open Data," Open Data Institute, 2015, http://bit.ly/2aJwxsF**.**

This report describes the potential benefits, challenges and next steps for leveraging open data to advance the Sustainable Development Goals.

The authors argue that the greatest potential impacts of open data on development are:

- More effectively target aid money and improve development programs
- Track development progress and prevent corruption
- Contribute to innovation, job creation and economic growth.

They note, however, that many challenges to such impacts exist, including:

- A weak enabling environment for open data publishing
- Poor data quality
- A mismatch between the demand for open data and the supply of appropriate datasets
- A "digital divide" between rich and poor, affecting both the supply and use of data
- A general lack of quantifiable data and metrics.

The report articulates a number of ways that "governments, donors and (international) NGOs — with the support of researchers, civil society and industry — can apply open data to help make the SDGs a reality:

- Reach global consensus around principles and standards, namely being "open by default," using the Open Government Partnership's Open Data Working Group as a global forum for discussion.
- Embed open data into funding agreements, ensuring that relevant, high-quality data is collected to report against the SDGs. Funders should mandate that data relating to performance of services, and data produced as a result of funded activity, be released as open data.
- Build a global partnership for sustainable open data, so that groups across the public and private sectors can work together to build sustainable supply and demand for data in the developing world."

OPEN DATA AND DEVELOPING COUNTRIES (NATIONAL CASE STUDIES)

Beghin, Nathalie and Carmela Zigoni, "Measuring Open Data's Impact on Brazilian National and Sub-National Budget Transparency Websites and Its Impacts on People's Rights," 2014, http://bit.ly/2au3LaQ**.**

This report examines the impact of a Brazilian law requiring government entities to "provide real-time information on their budgets and spending through electronic means." The authors explore "whether the national and state capitals are in fact using principles and practices of open data in their disclosures, and has evaluated the emerging impacts of open budget data disclosed through the national transparency portal."

The report leveraged a "quantitative survey of budget and financial disclosures, and qualitative research with key stakeholders" to explore the "role of technical platforms and intermediaries in supporting the use of budget data by groups working in pursuit of social change and human rights."

The survey found that:

- The information provided is complete.
- In general, the data are not *primary.*
- Most governments do not provide *timely* information.
- *Access* to information is not ensured to all individuals.
- Advances were observed in terms of the availability of *machine-processable data.*
- Access is free, *without discriminating* users.
- The minority presents data in non-proprietary format.
- It is not known whether the data are under *license.*

Boyera, S. and C. Iglesias, "Open Data in Developing Countries: State of the art," Partnership for Open Data, 2014, http://bit.ly/2acBMR7**.**

This report provides a summary of the state-of-the-art study developed by SBC4D for the Partnership for Open Data (POD).

A series of interviews and responses to an online questionnaire yielded a number of findings, including:

- "The number of actors interested in Open Data in Developing Countries is growing quickly. The study has identified 160+ organizations. It is important to note that a majority of them are just engaging in the domain and have little past experience. Most of these actors are focused on OD as an objective not a tool or means to increase impact or outcome.
- Local actors are strong advocates of public data release. Lots of them are also promoting the re-use of existing data (through e.g. the organization of training, hackathons and alike). However, the study has not identified many actors practically using OD in their work or engaged in releasing their own data.
- Traditional development sectors (health, education, agriculture, energy, transport) are not yet the target of many initiatives, and are clearly underdeveloped in terms of use-cases.
- There is very little connection between horizontal (e.g. national OD initiatives) and vertical (sector-specific initiatives on e.g. extractive industry, or disaster management) activities."

Canares, M.P., J. de Guia, M. Narca and J. Arawiran, "Opening the Gates: Will open data initiatives make local governments in the Philippines more transparent?" Open LGU Research Project, 2014, http://bit.ly/2au3Ond**.**

This paper seeks to determine the impacts of the Department of Interior and Local Government of the Philippines' Full Disclosure Policy, affecting financial and procurement data, on both data providers and data users.

The paper uncovered two key findings:

- "On the supply side, incentivising openness is a critical aspect in ensuring that local governments have the interest to disclose financial data. While at this stage, local governments are still on compliance behaviour, it encourages the once reluctant LGUs to disclose financial information in the use of public funds, especially when technology and institutional arrangements are in place. However, LGUs do not make an effort to inform the public that information is available online and has not made data accessible in such a way that it can allow the public to perform computations and analysis. Currently, no data standards have been made yet by the Philippine national government in terms of format and level of detail."

- "On the demand side, there is limited awareness on the part of the public, and more particularly the intermediaries (e.g. business groups, civil society organizations, research institutions), on the availability of data, and thus, its limited use. As most of these data are financial in nature, it requires a certain degree of competence and expertise so that they will be able to make use of the data in demanding from government better services and accountability."
- The authors argue that "openness is not just about governments putting meaningful government data out into the public domain, but also about making the public meaningfully engage with governments through the use of open government data." In order to do that, policies should "require observance of open government data standards and a capacity building process of ensuring that the public, to whom the data is intended, are aware and able to use the data in ensuring more transparent and accountable governance."

Canares, M., M. Narca and D. Marcial, "Enhancing Citizen Engagement Through Open Government Data," ODDC, 2015, http://bit.ly/2aJMhfS**.**

This research paper seeks to gain a greater understanding of how civil society organizations can increase or initiate their use of open data. The study is based on research conducted in two provinces in the Philippines where civil society organizations in Negros Oriental province were trained, and in the Bohol province were mentored on accessing and using open data.

The authors seek to answer three central research questions:

- What do CSOs know about open government data? What do they know about government data that their local governments are publishing in the web?
- What do CSOs have in terms of skills that would enable them to engage meaningfully with open government data?
- How best can capacity building be delivered to civil society organizations to ensure that they learn to access and use open government data to improve governance?
- They provide a number of key lessons, including:
- Baseline conditions should inform capacity building approach.
- Data use is dependent on data supply.
- Open data requires accessible and stable internet connection.
- Open data skills are important but insufficient.
- Outcomes, and not just outputs, prove capacity improvements.

Chiliswa, Zacharia, "Open Government Data for Effective Public Participation: Findings of a case study research investigating the Kenya's open data initiative in urban slums and rural settlements," ODDC, April 2014, http://bit.ly/2au8E4s**.**

This research report is the product of a study of two urban slums and a rural settlement in Nairobi, Mobasa and Isiolo County, respectively, aimed at gaining a better understanding of the awareness and use of Kenya's open data.

The study had four organizing objectives:

- "Investigate the impact of the Kenyan Government's open data initiative and to see whether, and if so how, it is assisting marginalized communities and groups in accessing key social services and information such as health and education;
- Understand the way people use the information provided by the Open Data Initiative;
- Identify people's trust in the information and how it can assist their day-to-day lives;
- Examine ways in which the public wish for the open data initiative to improve, particularly in relation to governance and service delivery."

The study uncovered four central findings about Kenya's open data initiative:

- "There is a mismatch between the data citizens want to have and the data the Kenya portal and other intermediaries have provided.
- Most people go to local information intermediaries instead of going directly to the government data portals and that there are few connections between these intermediaries and the wider open data sources.
- Currently the rural communities are much less likely to seek out government information.
- The kinds of data needed to support service delivery in Kenya may be different from those needed in other places in the world."

Chattapadhyay, Sumandro, "Opening Government Data through Mediation: Exploring the roles, practices and strategies of data intermediary organisations in India," ODDC, 2014, http://bit.ly/2au3F37**.**

This report seeks to gain a greater understanding of the current practice following the Government of India's 2012 National Data Sharing and Accessibility Policy.

Cattapadhyay examines the open government data practices of "various (non-governmental) 'data intermediary organisations' on the one hand, and implementation challenges faced by managers of the Open Government Data Platform of India on the other."

The report's objectives are:

- To undertake a provisional mapping of government data related activities across different sectors to understand the nature of the "open data community" in India
- To enrich government data/information policy discussion in India by gathering evidence and experience of (nongovernmental) data intermediaries regarding their actual practices of accessing and sharing government data, and their utilization of the provisions of NDSAP and RTI act
- To critically reflect on the nature of open data practices in India

Lwanga-Ntale, Charles, Beatrice Mugambe, Bernard Sabiti and Peace Nganwa, "Understanding How Open Data Could Impact Resource Allocation for Poverty Eradication in Kenya and Uganda," ODDC, 2014, http://bit.ly/2aHqYKi**.**

This paper examines case studies from Uganda and Kenya to explore an open data movement seeking to address "age-old" issues including "transparency, accountability, equity, and the relevance, effectiveness and efficiency of governance."

The authors focus both on the role "emerging open data processes in the two countries may be playing in promoting citizen/public engagement and the allocation of resources," and the "possible negative impacts that may emerge due to the 'digital divide' between those who have access to data (and technology) and those who do not.

They offer a number of recommendations to the government of Uganda and Kenya that could be more broadly applicable, including:

- Promote sector and cross sector specific initiatives that enable collaboration and transparency through different e-transformation strategies across government sectors and agencies.
- Develop and champion the capacity to drive transformation across government and to advance skills in its institutions and civil service.

SAPKOTA, KRISHNA, "EXPLORING THE EMERGING IMPACTS OF OPEN AID DATA AND BUDGET DATA IN NEPAL," FREEDOM FORUM, AUGUST 2014, HTTP://BIT.LY/2AP0Z5G**.**

This research report seeks to answer five key questions regarding the opening of aid and budget data in Nepal:

- What is the context for open aid and budget data in Nepal?
- What sorts of budget and aid information is being made available in Nepal?
- What is the governance of open aid and budget data in Nepal?
- How are relevant stakeholders making use of open aid and budget data in Nepal?
- What are the emerging impacts of open aid and budget data in Nepal?

The study uncovered a number of findings, including

"Information and data can play an important role in addressing key social issues, and that whilst some aid and budget data is increasingly available, including in open data formats, there is not yet a sustainable supply of open data direct from official sources that meet the needs of the different stakeholders we consulted."

"Expectations amongst government, civil society, media and private sector actors that open data could be a useful resource in improving governance, and we found some evidence of media making use of data to drive stories more when they had the right skills, incentives and support."

"The context of Nepal also highlights that a more critical perspective may be needed on the introduction of open data, understanding the specific opportunities and challenges for open data supply and use in a country that is currently undergoing a period of constitutional development, institution building and deepening democracy."

SRIVASTAVA, NIDHI, VEENA AGARWAL, ANMOL SONI, SOUVIK BHATTACHARJYA, BIBHU P. NAYAK, HARSHA MEENAWAT AND TARUN GOPALAKRISHNAN, "OPEN GOVERNMENT DATA FOR REGULATION OF ENERGY RESOURCES IN INDIA,"ODDC, 2014, HTTP://BIT.LY/2AU9OXF**.**

This research paper examines "the availability, accessibility and use of open data in the extractive energy industries sector in India."

The authors describe a number of challenges being faced by:

Data suppliers and intermediaries:

- Lack of clarity on mandate
- Agency specific issues
- Resource challenges
- Privacy issues of commercial data and contractual constraints
- Formats for data collection
- Challenges in providing timely data
- Recovery of costs and pricing of data
- Data users
- Data available but inaccessible
- Data accessible but not usable
- Timeliness of data

They make a number of recommendations for addressing these challenges focusing on:

- Policy measures
- Improving data quality
- Improving effectiveness of data portal

VAN SCHALKWYK, FRANÇOIS, MICHAEL CAŇARES, SUMANDRO CHATTAPADHYAY AND ALEXANDER ANDRASON "OPEN DATA INTERMEDIARIES IN DEVELOPING COUNTRIES," ODDC, 2015, HTTP://BIT.LY/2AJZTWI**.**

This paper seeks to provide "a more socially nuanced approach to open data intermediaries," moving beyond the traditional approach wherein data intermediaries are "presented as single and simple linkages between open data supply and use."

The study's analysis draws on cases from the Emerging Impacts of Open Data in Developing Countries (ODDC) project.

The authors provide a working definition of open data intermediaries: An open data intermediary is an agent:

- positioned at some point in a data supply chain that incorporates an open dataset
- positioned between two agents in the supply chain
- facilitates the use of open data that may otherwise not have been the case

One of the study's key findings is that, "Intermediation does not only consist of a single agent facilitating the flow of data in an open data supply chain; multiple intermediaries may operate in an open data supply chain, and the presence of multiple intermediaries may increase the probability of use (and impact) because no single intermediary is likely to possess all the types of capital required to unlock the full value of the transaction between the provider and the user in each of the fields in play."

VAN SCHALKWYK, FRANÇOIS, MICHELLE WILLMERS AND TOBIAS SCHONWETTER, "EMBEDDING OPEN DATA PRACTICE," ODDC, 2015, HTTP://BIT.LY/2AHT5XU**.**

This research paper was developed as part of the ODDC Phase 2 project and seeks to address the "insufficient attention paid to the institutional dynamics within governments and how these may be impeding open data practice."

The study focuses in particular on open data initiatives in South Africa and Kenya, leveraging a conceptual framework to allow for meaningful comparison between the two countries.

Focusing on South Africa and Kenya, as well as Africa as a whole, the authors seek to address four central research questions:

- Is open data practice being embedded in African governments?
- What are the possible indicators of open data practice being embedded?
- What do the indicators reveal about resistance to or compliance with pressures to adopt open data practice?

What are different effects of multiple institutional domains that may be at play in gov-

ernment as an organization?

VAN SCHALKWYK, FRANCOIS, MICHELLE WILLMERS, AND LAURA CZERNIEWICZ, "CASE STUDY: OPEN DATA IN THE GOVERNANCE OF SOUTH AFRICAN HIGHER EDUCATION," ODDC, 2014, HTTP://BIT.LY/2AMGIFB**.**

This research report uses the South African Centre for Higher Education Transformation (CHET) open data platform as a case study to examine "the supply of and demand for open data as well as the roles of intermediaries in the South African higher education governance ecosystem."

The report's findings include:

- "There are concerns at both government and university levels about how data will be used and (mis)interpreted, and this may constrain future data supply. Education both at the level of supply (DHET) and at the level of use by the media in particular on how to improve the interpretability of data could go some way in countering current levels of mistrust. Similar initiatives may be necessary to address uneven levels of data use and trust apparent across university executives and councils."
- "Open data intermediaries increase the accessibility and utility of data. While there is a rich publicly-funded dataset on South African higher education, the data remains largely inaccessible and unusable to universities and researchers in higher education studies. Despite these constraints, the findings show that intermediaries in the ecosystem are playing a valuable role in making the data both available and useable."
- "Open data intermediaries provide both supply-side as well as demand-side value. CHET's work on higher education performance indicators was intended not only to contribute to government's steering mechanisms, but also to contribute to the governance capacity of South African universities. The findings support the use of CHET's open data to build capacity within universities. Further research is required to confirm the use of CHET data in state-steering of the South African higher education system, although there is some evidence of CHET's data being referenced in national policy documents."

VERHULST, STEFAAN AND ANDREW YOUNG, "OPEN DATA IMPACT: WHEN DEMAND AND SUPPLY MEET," THE GOVLAB, 2016, HTTP://BIT.LY/1LHKQPO**.**

This report provides a taxonomy of the impacts open data is having on a number of countries around the world, comprising:

- Improving Government
- Empowering Citizens
- Creating Opportunity
- Solving Public Problems

The authors describe four key enabling conditions for creating impactful open data initiatives:

- Partnerships
- Public Infrastructure
- Policies and Performance Metrics
- Problem Definition

The report is based on 19 case studies on open data initiatives, including many from developing economies, such as:

- Mexico's Mejora Tu Escuela
- Open Education Information in Tanzania
- Kenya's Open Duka
- Indonesia's Kawal Pemilu
- Battling Ebola in Sierra Leone

ADDITIONAL RESOURCE

WORLD BANK READINESS ASSESSMENT TOOL

To aid in the assessment "of the readiness of a government or individual agency to evaluate, design and implement an Open Data initiative," the World Bank's Open Government Data Working Group developed an openly accessible Open Data Readiness Assessment (ODRA) tool.

Assessment reports have been published for:

- Ulynaovksk, Russian Federation
- Antigua and Barbuda
- Peru
- Mexico
- Dominican Republic
- Burkina Faso
- Kazakhstan
- Uganda
- Tajikistan
- Sierra Leone
- Serbia
- Kyrgyzstan

ENDNOTES

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