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## Planning and designing open government data programs: An ecosystem approach

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## ABSTRACT

The open government data (OGD) movement has rapidly expanded worldwide with high expectations for substantial benefits to society. However, recent research has identified considerable social and technical barriers that stand in the way of achieving these benefits. This paper uses sociotechnical systems theory and a review of open data research and practice guidelines to develop a preliminary ecosystem model for planning and designing OGD programs. Findings from two empirical case studies in New York and St. Petersburg, Russia produced an improved general model that addresses three questions: How can a given government's open data program stimulate and support an ecosystem of data producers, innovators, and users? In what ways and for whom do these the ecosystems produce benefits? Can an ecosystem approach help governments design effective open government data programs in diverse cultures and settings? The general model addresses policy and strategy, data publication and use, feedback and communication, benefit generation, and advocacy and interaction among stakeholders. We conclude that an ecosystem approach to planning and design can be widely used to assess existing conditions and to consider policies, strategies, and relationships that address realistic barriers and stimulate desired benefits.

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### 1. Introduction

Open access to government data has become a hallmark of the global open government movement. A legal framework for public information access is the second of four membership criteria for the global Open Government Partnership which has grown from eight member countries at its founding in 2011 to 65 members in 2015 (Open Government Partnership, n.d.). In 2011, the UN issued guidelines for open data programs for member states particularly for purposes of transparency and citizen engagement (United Nations Division for Public Administration and Development Management, 2013). By 2013, 95 nations had adopted access to information laws and procedures, and international organizations from the Organization of American States to the African Union had adopted resolutions, treaties and model legislation endorsing and promoting open access (Open Society Justice Initiative, n.d.).

Open government data (OGD) programs have been launched in many different countries, cultures, and political systems while also rapidly expanding to sub-national and municipal levels. OGD programs

typically comprise a set of formal directives, rules, and practices that apply to all or most administrative organizations within a government. Under these programs, government organizations are required to make their machine-readable data discoverable, available, and downloadable through dedicated internet portals without cost to potential data users.

Despite the political emphasis on citizen engagement, OGD users are usually not "citizens" in the ordinary sense of that term but rather they are technologically skilled data analysts or application developers who can make use of data in these technical formats. Sometimes these users rely entirely on OGD, sometimes they compare or combine it with data from other sources to produce applications or services. The resulting products may be offered without charge or they may be the basis for revenue-generating businesses.

### 2. Open government data benefits and barriers

Conceptually, the appeal of open government data (OGD) is undeniable given its underlying motivations to improve democratic governance and political participation, and to foster service improvements and business and civic innovation (Huijboom & Van den Broek, 2011; Robinson, Yu, Zeller, & Felten, 2009). Expectations for substantial benefits are high, and investment is considerable as evidenced by the sheer number of OGD portals and programs (Manyika et al., 2013). McKinsey analysts estimate that OGD can potentially stimulate \$3 trillion in

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benefits throughout the global economy through better decisions, new products and services, and greater transparency and accountability (Chui, Farrell, & Jackson, 2014). In addition, a study of the development of OGD in the UK noted that sustainability requires that the government itself experience benefits as a data supplier and user (Heimstädt, Saunderson, & Heath, 2014). Janssen, Charalabidis, and Zuiderwijk (2012) categorized the expected benefits of OGD in three ways. Political and social benefits include greater transparency and accountability, increased trust in government, improved policy making processes, enhanced citizen services and satisfaction, and creation of new insights within the public sector. Economic benefits encompass such results as growth and competitiveness; encouragement for innovation; improved processes, products, and services; and useful information for investors and firms. Operational and technical benefits to government itself include data reuse, optimized administrative processes, external data validation, and the ability to integrate public and private data.

At the same time, a long list of sociotechnical risks and barriers to OGD adoption and effectiveness has also been identified (Barry & Bannister, 2014; Janssen et al., 2012; Martin, Foulonneau, Turki, & Ihadjadene, 2013; Zuiderwijk, Janssen, Choenni, Meijer, & Sheikh Alibaks, 2012). Barriers associated with governance and institutional factors include resistance and risk aversion, lack of appropriate legislation or uniform policies for data publication, lack of processes for dialog with users, inattention to the differences among levels of government, and lack of resources to launch and sustain an OGD program. Other barriers pertain to the complexity of activities needed to identify, understand, and use data. OGD participation barriers include lack of incentives, capabilities, business models, and contextual and technical knowledge among users. Additional barriers stem from problems with data provenance, management, and quality including validity, completeness, metadata, and technical and semantic interoperability (Dawes & Helbig, 2015), as well as concerns for privacy, confidentiality and liability (Chui et al., 2014). Overall, the greatest impediments appear to stem from the fact that open data initiatives are largely supply-driven (Janssen et al., 2012). They lack sufficient attention to the user perspective despite the fact that the benefits of OGD programs are expected to come mostly from innovative external data use (Zuiderwijk et al., 2012). Because of this bias toward the supply side, too little emphasis has been placed on feedback and interdependencies among suppliers, users, and intended beneficiaries. Equally problematic is the paucity of attention to other important roles for government to play beyond policy making and data provision, among them acting as a catalyst and convener of stakeholders as well as a sophisticated data analyst and data consumer (Chui et al., 2014).

Serious attention is only beginning to be paid to the practice dimension of OGD. A study in the Netherlands showed how the heterogeneous nature of local government departments is reflected in diverse policies and practices for data collection, management, use, and release, with quite varied OGD program results from department to department (Conradie & Choenni, 2014). In Ireland, a study of senior managers in both central and local governments identified six categories of barriers to realization of desired economic benefits of OGD: economic, technical, cultural, legal, administrative, and risk related (Barry & Bannister, 2014). Of 20 individual barriers identified, the most problematic appeared to center around staff and funding constraints, potential loss of revenue, and uncertainty surrounding compliance with the Data Protection Act.

Other research has documented concerns for harmonizing security and openness as important but sometimes competing information management principles, balancing attention to internal information needs vs. the needs of secondary data users (Dawes & Helbig, 2010), accommodating traditional legal, budgetary, and authority constraints (Cole, 2012) and recognizing the differences among levels of government, cultures, and political systems (Davies & Bawa, 2012).

As a consequence of laudable expectations juxtaposed against numerous barriers and limitations, the performance of OGD programs

tends to be simplistically described and popularized by counting the number of participating governments, or the number of participating organizations within the government, or the number of datasets released, accessed or downloaded. Illustrations and anecdotes are used to show the value of individual applications, often by highlighting the winners of government-sponsored application contests or challenges. However, the vast majority of OGD applications and services tend to be built by individuals, free-lancers, and researchers mainly for mobile devices using a single static data set (Loutas, Varitimou, & Peristeras, 2012). Most are offered for free, very few integrate data from different sources. In short, very few of the sustained commercial applications or break-through analyses that advocates hope for have actually been produced.

Several authors describe this tendency to oversimplify as mythical belief in the benefits of OGD and the ease of obtaining them. These include the belief that publishing data automatically yields benefits, that all constituents can make use of published data, that open data will result in open government (Janssen et al., 2012), and that some direct connection exists between the amount of information made public and enhancements in democracy (Strathern, 2000).

Given desired benefits, myriad barriers, and low levels of data exploitation, we contend that open government data programs will perform well only if they are designed with an appreciation for their full complexity. They must address not only the needs and capabilities of government data providers and private data users, but also the characteristics of the data itself, the nature of broader community resources and stakeholders, and the relationships among them. These considerations demand a more systemic approach to program planning and design.

In their work on more traditional information access programs, Dawes, Pardo, and Cresswell (2004) concluded that effective information access programs reflect a careful assessment of the mutual influences among data characteristics, uses, users, and organizational setting. More recently, expert observers have characterized OGD programs as “one-way streets” that need to become “ecosystems” with cycles of feedback between data users and suppliers (Pollock, 2011). Davies contends that OGD programs need two strategies: a coordinating strategy to build sound data infrastructures and a collaboration strategy to mobilize ecosystems of political, social, and technical resources that can work toward desired ends. Harrison, Pardo, and Cook (2012) discuss how the mutual interdependencies inherent in OGD ecosystems make it possible for them to deliver value while researchers in Ireland identified eleven ecosystem components having to do with data content, quality, protection, and use, as well as user engagement, public agency support, and program evaluation (Lee, 2014).

We find the ecosystem metaphor, with its emphasis on an evolving, self-organizing system of feedback and adjustment among actors and processes, to be a useful heuristic for approaching the design of effective OGD programs. Accordingly, in the remainder of this paper, we review relevant research literature and practice guidelines on OGD to derive a preliminary ecosystem model to guide program planning and design. We then present our research methodology and report on two diverse case studies, in New York City, USA and St. Petersburg, Russia using the preliminary model to trace the actors, influences, and relationships that exist in both cities. The paper concludes with a refined model, a discussion of the findings, and thoughts on next steps for research and practice.

### 3. Design considerations for open government data programs

#### 3.1. Theoretical foundations

Open government data programs are sociotechnical phenomena that exist in multi-actor physical and institutional environments. They combine organizational, human, material, and technological aspects in a dynamic interplay of interdependencies and mutual influences within

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