Promoting the Use of Open Government Data: Cases of Training and Engagement

Mila Gascó-Hernández[1,2], Erika G. Martin[2,3], Luigi Reggi[2], Sunyoung Pyo[2], Luis F. Luna-Reyes[1,2,4,5]

1 Center for Technology in Government, University at Albany, Albany, NY, USA
2 Department of Public Administration & Policy, University at Albany, Albany, NY, USA
3 Rockefeller Institute of Government, Albany, NY, USA
4 Department of Information Science, University at Albany, Albany, NY, USA
5 Universidad de las Americas Puebla, Mexico

Abstract

In the last decade, governments around the world have created open government data (OGD) repositories to make government data more accessible and usable by the public, mostly motivated by values such as improved government transparency, citizen collaboration and participation, and spurring innovation. The basic assumption is that once data are more discoverable, accessible, available in alternative formats, and with licensing schemes that allow free re-use, diverse stakeholders will develop innovative data applications. Despite OGD's potential transformative value, there is limited evidence for such transformation, particularly due to scarce data use, which is partly attributable to the lack of technical skills and user training. To advance the dialogue around methods to increase awareness of OGD, improve users' skills to work with OGD, and encourage data use, the paper compares and contrasts how three training interventions in Spain, Italy, and the United States have sought to improve users' skills and engaged them in their use of OGD. We report three main findings. First, introduction and analysis skills are taught in combination to encourage use of open data. Being aware of OGD and its benefits is insufficient to promote use. Second, OGD training seems to be more effective when complemented with knowledge about context and interactions with government. Finally, embedding the training interventions in the specific contexts and considering the unique characteristics, interests, and expectations of different types of users is critical to success.

Keywords

Open government data, Citizen engagement, Open government data users, Open government data skills, Information literacy

1. INTRODUCTION

In the last decade, governments around the world have created open government data (OGD) repositories to make government data more accessible and usable by the public. The OGD movement has been motivated by values such as improved government transparency, citizen collaboration and participation, and spurring innovation (Harrison et al., 2012). The basic assumption is that once data are more discoverable, accessible, available in alternative formats desired by multiple users, and with licensing schemes that allow free re-use, diverse stakeholders will develop innovative data applications (Chan, 2013; Janssen, Charalabidis, & Zuiderwijk, 2012). Within the public sector, OGD has been associated with three main democratic activities: monitoring government actions to promote transparency and accountability; deliberating and discussing policy alternatives; and participating and collaborating in the design, implementation, and evaluation of government services (Baldwin, 2014; Ruijer, Grimmelikhuijsen, & Meijer, 2017). Outside the public sector, OGD can potentially increase economic growth through the development of sustainable data-driven innovations (Baldwin, 2014; Grant, 2016; Susha, Grönlund, & Janssen, 2015).

Although it is common to attach a transformative value to OGD, there is limited evidence for such transformation, particularly due to scarce data use (Martin, 2014). The OGD movement has been primarily a supply- driven initiative, spurned by the new availability of datasets and other potentially valuable information resources (Ohemeng & Ofosu-Adarkwa, 2015; Styrin, Luna-Reyes, & Harrison, 2017). However, current research suggests that data use is scarce, there is limited involvement of non-profits, and the direct participation of citizens is almost non-existent (Safarov, Meijer, & Grimmelikhuijsen, 2017; Styrin et al., 2017). Furthermore, there are only isolated efforts to understand the characteristics of OGD users, such as their intended use, skills and expertise, and types of tasks they desire performing with the data (Graves & Hendler, 2014; Martin & Begany, 2017a; Susha et al., 2015).

There are several factors that influence the use of OGD (Janssen et al., 2012; Martin, Law, Ran, Helbig, & Birkhead, 2017; Susha et al., 2015). Limited technical skills is an important barrier (Graves & Hendler, 2014; Lyon et al., 2015; Safarov et al., 2017): most users lack the skills required to assess the quality of the data and its fitness to use, and awareness of what they can do with the data. Although user training is a critical component of facilitating OGD use, there is limited research on strategies to train diverse users. A major challenge is that as OGD portals expand the number and variety of users, it is unclear who the new users are and what they desire (Martin & Begany, 2017a; Janssen & Zuiderwijk, 2014; Zuiderwijk, Janssen, & Davis, 2014). To advance the dialogue around methods to train users and improve their data skills, we compare and contrast three training interventions to promote the use of OGD in Spain, Italy, and the United States, discussing how they improved users' skills and engaged them in their use of OGD. This comparison allows us to explore the desirable effects of improving such skills and knowledge, to analyze how this can be accomplished through training and engagement initiatives, and to identify important challenges and useful strategies. To accomplish our objective, the paper is organized in five more sections besides this introduction. The coming section discusses OGD, particularly focusing on users and main challenges in developing user engagement with OGD. The third section of the paper presents our research method and data sources. The fourth section of the paper includes a description of each of the three cases. The fifth section compares how these trainings were implemented, their early outcomes, and key challenges. We finish the paper by summarizing our current progress and pointing to further developments.

2. LITERATURE REVIEW

We start this section with a brief introduction to OGD and its main challenges, and we continue with a summary on main users and skills needed to take advantage of OGD.

2.1. Open Government Data Challenges and Barriers to Use

Open government data is commonly defined as data produced with public resources and made publicly available with a license that allows for re-use and re-packaging in innovative applications (Janssen et al., 2012). Although some definitions of OGD include a requirement to be machine-readable, for other perspectives it is sufficient to have a free use license. OGD practitioners have identified a quality standard based on the degree of data openness, with "five star" OGD being available online, in structured formats, usable in free software packages, with web addresses or other uniform resource identifiers to enable users to locate data, and linked to other data to develop applications (Berners-Lee, 2009; Martin & Begany, 2017b).

Current experiences demonstrate that the OGD movement faces several challenges. A set of challenges is related to the data publication process, including the lack of willingness to open data because of organizational culture and capabilities (Yang & Wu, 2016; Wirtz, Piehler, Thomas, & Daiser, 2016; Wirtz et al., 2016; Zuiderwijk, Janssen, Choenni, Meijer, & Alibaks, 2012), legal and regulatory issues, particularly those related to privacy and security (Zuiderwijk & Janssen, 2014; Janssen et al., 2012; Martin & Begany, 2017a; Styrin et al., 2017; Zuiderwijk et al., 2014; Khayyat & Bannister, 2015), technical challenges, such as the unavailability of a supporting infrastructure to the lack of standards, fragmentation, and legacy systems (Janssen et al., 2012; Lyon et al., 2015; Martin & Begany, 2017a), skills and knowledge gaps among public managers involved in all stages of the data production cycle, from data collection to publication and archiving (Lyon et al., 2015; Martin & Begany, 2017b; Zuiderwijk et al., 2014), and economic factors, which include resources needed by government agencies to curate and publish the data (Barry & Bannister, 2014).

Although challenges in the publication process constitute key factors to resolve in order to make data available, important difficulties are also experienced on the side of data users inside and outside government (Susha et al., 2015). For data innovators, ensuring sufficient resources and a proper revenue

model are key challenges to promoting OGD use (Susha et al., 2015). As data become open to new users, they may not have the required technical skills to download, make sense of and use the data, domain-specific knowledge to understand the data or identify potential uses, or access to infrastructure to get benefits from OGD (Lyon et al., 2015; Martin, 2014). At a very basic level, even data-savvy potential users are not always aware of the existence of OGD as a public resource (Martin, Birkhead, & Helbig, 2015). Yet, skills and technical knowledge are commonly considered basic conditions of OGD use (Safarov et al., 2017) and the most important asset from the point of view of innovators and end users (Graves & Hendler, 2014; Hjalmarsson, Johannesson, Juell-Skielse, & Rudmark, 2014; Susha et al., 2015). Common challenges associated with user knowledge include the lack of knowledge to use or to make sense of the data as well as lack of statistical knowledge (Janssen et al., 2012). The lack of interactive functionalities and user-centered design of OGD platforms has also been identified as a main factor limiting data use (Zuiderwijk, Janssen & Susha, 2016). Platform characteristics may even involve barriers to access the data, despite being published, for example, by is requiring registration or charging a fee (Janssen et al., 2012). The lack of dialogue between data providers and users has also been reported as an important barrier (Martin et al., 2013).

Interestingly enough, there are certain users' challenges that also affect OGD providers. It is the case of information quality, commonly defined as fitness for use (Barry & Bannister, 2014; Helbig, Cresswell, Burke, & Luna-Reyes, 2012; Janssen et al., 2012; Safarov et al., 2017). Data quality is constrained by its completeness, accuracy, and other issues related to its original collection (Martin & Begany, 2017b; Martin et al., 2017). Additionally, OGD is usually collected with specific administrative requirements that are usually very different from those of alternative applications, making re-use, for both providers and users, a challenging endeavor (Helbig et al., 2012). Developing a sustainable business model remains

an unsolved problem for both providers and users (Barry & Bannister, 2014; Janssen & Zuiderwijk, 2014).

2.2. Open Government Data Skills and User Engagement

As the previous section suggests, one of the key barriers for OGD use is the lack of technical skills and domain knowledge, and previous works have widely recognized the importance of having the appropriate skills to take full advantage of the transformative potential of OGD. There is a literature gap on interventions to improve users' skills and knowledge. The three cases described in our article are a first step towards understanding the desirable effects of different types of interventions to engage potential users and enhance their skills. As our cases target different users in alternative contexts, we first review the existing scarce literature on government data users as well as needed skills.

There are multiple users of OGD, and reaching new audiences beyond the traditional users of specific datasets is an important benefit of OGD (Baldwin, 2014; Martin & Begany, 2017a; Safarov et al., 2017; Susha et al., 2015). Figure 1 illustrates these users and examples of OGD use. Each type of user has different interests and intended use. First, government employees may use the data to improve public services as well as decision and policy making processes (Lyon et al., 2015; Martin & Begany, 2017a). A second category of users is innovators, which include individual programmers and developers as well as established businesses (Grant, 2016; Safarov et al., 2017). They use the data with innovation purposes: usually, these data users develop a new information product or service and commercialize it (Bria et al., 2015). A third type of users encompasses researchers, data journalists, and activists seeking to use OGD to create knowledge in different formats: researchers may use OGD for pilot studies, to advance the literature, or to apply basic or advanced analytics to better understand a problem; data journalists may be interested in analyzing large data sets to identify potential news stories; and activists may aim at using the data to promote transparency or accountability, or to assess and influence policy (Graves & Hendler,

2014; Safarov et al., 2017). Citizens are a fourth category of users who almost never consume OGD directly, but instead most commonly use data through one or more mediators. By providing citizens with an essential window into the functioning of government, OGD enables citizens to be informed, hold their governments accountable, and engage in participation processes (Dawes, Vidiasova, & Parkhimovich, 2016; Harrison et al., 2012; Reggi & Dawes, 2016; Ruijer et al., 2017).

Figure 1. Open government data users and uses. Source: Adapted from (Begany & Martin, 2017)

In terms of skills needed to use OGD, the Open Data Institute (ODI) has developed a framework that includes six basic skills sets (see https://theodi.org/open-data-skills-framework): introduction (introducing open data and creating value), publishing (using platforms, improving quality, choosing formats, linking data, cleaning data, and boosting usability), management (sustaining open data, building communities, licensing data, measuring success, and managing change), business (innovating with data, designing services, and generating revenue), analysis (applying statistics, using data analytics, finding

insights, deploying data science, visualizing data, and interacting with data), and leadership (prioritizing action, developing strategy, developing policy, and leading change). Additional approaches refer to similar skills, although they use different names. Miller (2016), for example, presents a set of skills that involve defining a problem, wrangling data, self-managing data, choosing analytical methods, analyzing and communicating findings, and engaging in lifelong learning. Other authors include awareness of the concept of open data, understanding of the context and application domain, managing data, analytical methods, literacy on the use of OGD platforms and related technologies, and techniques for stakeholder involvement (Gil-Garcia, Pardo, & Luna-Reyes, 2017; Puron-Cid, Gil-Garcia, & Luna-Reyes, 2016; Zhang, Luna-Reyes, & Pardo, 2016).

Finally, additional works focus on the concept of data literacy, defined as the set of competencies to use and produce data in a critical way, including data reading skills (understanding how the data is produced), data processing skills (applying computational and statistical tools to transform data), data communication skills (matching data types and communications tools), and data production skills (deepening all elements within data reading) (Tyger & Kirsch, 2016). Other approaches to data literacy include different competency levels according to the education level of the data user (undergraduate/graduate): critical thinking, data analysis, data curation, data information management, data mining, data visualization (also emphasized in the work of Zubiaga & Mac Namee, 2016), research skills, and statistical skills (Atenas et al., 2015). Despite these initial connections, the literature is scarce in relating types of users and needed skills.

In this article, we adopt the Open Data Institute's framework because of its internal consistency and wider scope. Moreover, being the guiding framework for the ODI training strategy and practice, it has the potential of offering both academic and practical implications. Considering the framework as a starting point, we suggest that all types of users need some basic understanding on OGD, defining problems and engaging in lifelong learning, but also need to develop particular strengths in one or more

additional sets of skills. Thus, we posit that government employees will require skills from the publishing, management, and leadership categories. Innovators may require some of the management skills, particularly those associated with community building, business, and analysis. Researchers, data journalists, and activists primarily need analysis skills, although leadership skills would help them lead change by using OGD.

3. METHODS

The main objective of this article is to explore the desirable effects of improving users' skills and knowledge by means of training and engagement initiatives. This is novel because it moves from descriptive studies of the different types of users and challenges to engaging them, and towards identifying actionable strategies to train them to enhance use. Our study is therefore motivated by the following research question: how do different training projects address the needs of skills and knowledge of different types of OGD users? We have selected the case study approach for this research, which is particularly useful to respond to questions related to why or how (Yin, 1994). In addition, case studies show how particular practices are developed in particular organizations and, therefore, help refine theory (Scapens, 1990). Qualitative case studies also allow us to study the research question in depth while leaving room for unexpected interesting findings that can form the basis for concrete hypotheses to be tested in future research (Marshall & Rossman, 2011; Yin, 1994). This is particularly useful when there is little existing research on the topic (Yin, 1994), as is the case here.

Case selection was guided by a combination of convenience and theoretical sampling. In particular, the latter played an important role because we aimed at providing preliminary insights and developing conceptual ideas rather than amassing general information. We therefore looked intentionally into diverse populations, various types of trainings, and different contexts, which were needed to help the authors clarify understanding of open data training and engagement (Patton, 2002; Strauss & Corbin, 1998). The search for cases resulted in one case involving current and future public and non-profit

managers enrolled in a Master of Public Administration (MPA) or related graduate certificate program in the United States, a second case including Italian students from kindergarten through twelfth grades (K-12), and one last case involving different types of users in Spain.

The research team had first-hand access to case data and also language and contextual knowledge required to compare cases across countries, allowing us to collect primary data to address our research questions. Thus, in addition to our goal of understanding different types of training in their specific contexts, the different level of involvement of the authors in each of the three cases drove our choice of data collection methods.[1] Data for the MPA case came from class documentation and assessment artifacts. Assessment artifacts included a midterm examination, a written policy memo assignment, and a satisfaction survey applied in the last day of class. Class documentation included the class syllabus as well as the specific class scripts and homework assignments. Authors in the paper were directly involved in team-teaching the class.

In the case of Monithon, the data was collected by conducting four interviews during March 2016, three with the members of the initiative's steering committee and one with the manager of the project "OpenCoesione School" of the Italian Government. The quantitative data included in the case is based on the analysis of the 177 "civic monitoring reports" found on Monithon.it website in January 2017.

The data for the Spanish case study come from five key informant interviews with the founders of the organization offering the training and some of the teachers; these occurred during May 2017. Discussion topics included the description of the project (purpose, actors involved, history of implementation), training offered, target population, skills developed, main results, and key challenges. Website documentation, including news, description of the courses, and blogs, was also analyzed.

[1] Data collection protocols can be obtained from the authors.

4. CASE VIGNETTES

4.1. Overview of Three Cases

As noted, three training interventions were selected on the basis of their relevance to OGD-specific skills, accessibility to a diverse audience, and diverse environment which allow for a comparison. The first case ("Future Public Managers") encompasses training first-year graduate students enrolled in a Master of Public Administration or related graduated certificate program in Albany, New York, USA. This graduate program trains students to be leaders in governmental and civil society organizations, and the open data training course is now embedded within one of the data analysis courses required for all students. The second case ("Monithon") is a civil society initiative created by a group of open data activists and enthusiasts seeking to engage the public in using data from the Italian open data portal OpenCoesione.gov.it to verify how Italy spends Structural and Investment Funds from the European Union. In addition to training interested citizens and NGOs, it has expanded to thousands of high school students. The third case ("Barcelona Open Data Initiative") is a data initiative in Barcelona, Spain that aims to educate and empower citizens in the use of open data through numerous training programs. There are multiple formats tailored to different audiences, ranging from public awareness activities to short training courses of a few hours to intensive workshops tailored to specific NGOs.

These cases are valuable examples because they represent three geographical contexts, target different audiences, have alternative instructional designs and fee structures for participants, and use different datasets for instruction. Although a comparison of these three cases cannot answer a question about which format is most effective, these cases do illustrate how training programs can be easily adapted to different contexts and participants' interests.

4.2. Future Public Managers

4.2.1. Overview of Training Program

The University at Albany is a public university in Albany, New York (United States) with a highly-ranked school of public affairs. The flagship program of its public affairs college is its Master of Public Administration degree, and related graduate certificate programs, which train future public managers. Most of the graduate students in these degree programs seek careers in the government or non-profit sectors, and each student cohort also includes mid-career executives looking for additional training relevant to their positions. Although each student selects concentrations in which they receive specialized training, all students take a required set of core courses that provide basic skills in data analysis, financial management, leadership, and professional development.

Starting in September 2016, the public affairs faculty redesigned the core course, "Data, Models, and Decisions." This four-credit course is required for all Master of Public Administration students, and is also taken by many graduate certificate students and occasionally by graduate students from other departments. The tuition fee for the course is $1,800 for in-state students and $3,700 for out-of-state and international students, excluding other university fees. The revised curriculum includes six weeks of training on basic data literacy, how to manipulate data in Microsoft Excel, advanced data analysis and visualization in Excel, and basic data management in Microsoft Access. The curriculum focuses on Excel and Access because they are the most commonly used software packages in the public and nonprofit sectors. All of the data for the in-class activities and homework assignments are based on data from Health Data NY, the state's open health data portal, and HealthData.gov, the federal open health data catalog. The didactic format consists of weekly four-hour sessions, in which instructors alternate between short lectures and interactive group activities. Additionally, students complete weekly homework assignments that reinforce the concepts and skills covered during the lectures.

Most activities used one of two datasets: in-class exercises primarily focused on New York's hospital discharge data, and homework assignments primarily used New York's food restaurant establishment inspection data. Although both datasets are produced by the state's Department of Health, they have

different features that make them useful for student learning. The hospital discharge data are based on medical billing records. The dataset is very large, with about 140,000 records, some fields are masked or aggregated to a high level (such as age groups of ≤18, 18-64, and ≥65 years) to minimize re-identification risk, and include information on costs and charges (not an intuitive topic for most students). The food restaurant inspection data is based on reports submitted by health department staff and contain more descriptive information about food establishments and their violations. Although this dataset is smaller in size and more manageable for manipulations, it contains geolocation data and text fields that need to be summarized meaningfully.

During the first four weeks, students learned how to locate and download the hospital discharge data, read its metadata, conduct exploratory analyses, and create tables and charts. Throughout the exercises, instructors and students frequently discussed data challenges related to data quality, meaning, and policy issues such as reconciling differences between hospital costs and charges, how to de-identify data, and how to manage large datasets. The last two weeks cover data modeling, data management principles, and basic operations on a relational database in order to better understand both management and technical rules to manage data more effectively. To make the content more relevant to students' careers, instructors frequently link class discussions on the data to broader policy debates, such as why hospital facilities charge different fees for the same procedure, and why patients with different health insurance plans receive higher or lower bills for the same procedure. In-class discussions also focus on issues that students are likely to encounter in their future careers, such as how to communicate evidence to different stakeholders, and why it would be challenging for a government agency to redesign the food safety inspection report forms and data reporting processes.

4.2.2. Early Outcomes

There were two major assessments for this module. The first was a written assignment in which students prepared a memo to the state's health commissioner regarding trends in food safety violations. This

challenged the students to understand the structure and meaning of the restaurant inspection data, as well as to summarize the data meaningfully to make a recommendation for action, based on their analysis. The second assessment was a mid-term exam that required students to perform data manipulations in Excel and Access on new datasets they had not previously viewed or used in class. Students also provided feedback on the course in their end-of-term evaluations.

Most students were able to successfully complete the memo assignment, demonstrating an ability to synthesize information from a large dataset into a couple summary charts and make a cohesive story about whether food safety improved, worsened, or remained the same; and how to interpret the data meaningfully despite its limitations. In the follow-up class discussions, students expressed surprise that they came to sometimes divergent conclusions and explored reasons why data analysts may develop alternative explanations. On the midterm exam, most students were capable of performing advanced Excel manipulations and basic Access functions on datasets they had not yet encountered, showing that they were able to transfer the data skills they learned using the hospital discharge and food safety OGD examples. Finally, students reported in their semester evaluations that they were engaged in the exercises; felt more prepared to work with data, including searching, downloading, assessing fitness for use, and exploring contents; were more critical of other data-based reports; and had a new awareness of the large volume of government data, challenges to producing high-quality data, and how it could be used for policy analysis.

4.2.3. Challenges

There were several challenges to implementing this training course. First, although most students performed well on the assessments, there were some students who had not yet mastered the skills. However, we do not view this as a major barrier, given that the course is typically one of the most difficult core courses. Second, although students generally reported high satisfaction with the hands-on didactic format, a common complaint was a desire to analyze datasets in other policy domains. Third,

the program is currently limited in scope, with its intensive face-to-face format and required tuition fee. Although it could be possible to adapt the course into a massive online open course (MOOC), the university structure offers limited incentives to do so.

4.3. Monithon

4.3.1. Overview of Training Program

Monithon, or "monitoring marathon" of public spending, is a civil society initiative created in 2013 by a group of OGD activists and enthusiasts. The aim is to engage local groups such as non-governmental organizations (NGOs), informal communities, or high-school students in verifying how Structural and Investment Funds from the European Union (EU) are spent in Italy. This new information can be then channeled to local governments with the goal of improving policy effectiveness.

This "civic monitoring" uses OGD from OpenCoesione.gov.it, the national portal that publishes information on more than 950,000 projects funded by the European Structural Funds and other Italian national funds. These funds are one of the main sources of public investment in Southern Italy and deal with numerous national and local development policies, from supporting new businesses to infrastructure development such as broadband, local transportation, or water supplies.

Monithon's central staff, mainly composed of volunteers, is responsible for developing the common tools and methodology. It also facilitates the dissemination of this practice to new or existing local groups on the ground. Each group is free to decide which EU-funded project to assess, how to design the monitoring campaign, and how to reach government officials and political leaders. However, the results of all investigations are published in a standard "civic monitoring report" that is validated by staff. This standardized format allows for the collection of comparable information.

The training activities play a pivotal role in this civic monitoring. All investigations are accompanied by some training, which can be more or less structured depending on the target and the capacity of each group or local initiative.

A first type of training is focused on students. The project "A Scuola di OpenCoesione" (ASOC) or "OpenCoesione School," which is funded and carried out by the Italian government in cooperation with the Ministry of Education and the European Commission, uses Monithon's tools and methods to engage high-school students in a six-month course focused on OGD, data journalism, and civic monitoring of public spending. The course, which combines asynchronous content in the form of a MOOC with group activities and in-class sessions, aims at developing a wide spectrum of skills, including the identification of relevant OGD on local socio-economic contexts, basic statistical data analysis, data visualization, basic field research (e.g. conducting interviews, gathering evidence on the results of funded interventions), problem solving, communication of results in creative or interactive formats, and community engagement. More importantly, students learn how to connect and interact with public authorities, such as political leaders and government employees responsible for implementation of the funded projects.

A second type of training activity specifically targets citizens. These activities are typically conducted by NGOs using Monithon's training toolkit to create local "civic monitoring schools." One example is the European Commission-funded "Integrity Pact" project. This was implemented by Action Aid Italy, in partnership with Monithon and an anti-corruption NGO named Gruppo Abele, using a model from Transparency International. This model of civic control of public spending is based on a pact between two actors –a local government receiving EU funds and a civil society organization in charge of monitoring both the legal and procedural aspects of the project's implementation and its effectiveness. The Integrity Pact in Sibari (Calabria region) monitors a set of specific interventions to protect cultural resources in a well-known archeological area. Interested citizens, local NGOs staff, and activists

participate in these civic monitoring schools to acquire specific knowledge on the policy mechanisms of EU funding (including their complex governance structure), and other contextual information in the field of local development and cultural heritage management. Participants also learned on how to access government information through legal instruments like a freedom of information act request. Similar training courses, although less structured, have been tested in the cities of Bologna, Bari, Brindisi, Taranto, Pisa, and Ancona.

4.3.2. Early Outcomes

One major success has been the large number of participants who have been trained. From 2014 to 2017, thousands of secondary students from more than 400 schools across Italy have participated in the course. At the college level, the Europe Direct Center of the City of Turin and local Monithon group adapted the ASOC course for the University of Turin's students. Beyond formal education settings, in 2017, dozens of local communities and individual citizens participated in a civic monitoring school.

A second important outcome has been the volume of reports, which reflects the high penetration of the training across Italy and interest in the program. As of March 2017, 177 public interventions were monitored, worth over 1.2 billion Euros. Sixty-eight percent of the civic monitoring reports were created by the ASOC high school students, signaling that new citizens are being trained to use data. While almost all reports incorporate an analysis using OGD and other publicly available information, 88% of the investigations additionally included a visit to gather further evidence on the impact of the public funding. People interviewed included officials responsible for the interventions (74%), the final beneficiaries (51%), and public representatives such as town councilors or mayors (28%). Overall, the civic monitoring reports concluded that 67% of the funded projects had favorable results, 24% faced critical problems, and 6% were ineffective even after complete implementation that was in compliance with the initial proposal. The remaining 3% could not be assessed because the projects had just started at the moment of the investigation, so no sufficient evidence could be collected. Most reports provided

actionable feedback: 36% contained specific suggestions to overcome these difficulties, while the remaining offered more general ideas such as improving the project's governance or public communication strategies. These recommendations demonstrate that training program participants are able to synthesize the quantitative findings into actionable information.

A third outcome comprises anecdotal cases of reports leading to new policy decisions. For example, the ASOC students from Locri (Calabria region) found that a youth community center, created using a renovated building seized from an organized crime organization, was not operational because the municipality could not select an NGO to take over its management. The students drew the attention of the national government and the European Commission through their well-designed campaign. As a consequence, a new call for bids was issued, taking the students' input into consideration.

4.3.3. Challenges

The main challenges that citizens encountered during the training activities and the actual investigations include the lack of comprehensive data on the policy goals and decisions for the funding and project's outputs, the insufficiency of OGD at the local level (especially in small towns lacking open data portals), and the complexity of the local governance, which makes it difficult to identify the actors involved and to hold them accountable. An additional challenge was the financial sustainability throughout the civic monitoring process, from the maintenance of the common tools at the national level, to the engagement of communities and individual people on the ground. Also, although high school students training was funded by a national public organization, training activities addressed to activists and communities mainly relied on volunteer efforts.

Even though the majority of the investigations succeeded in reaching policy makers, posing questions and giving suggestions during interviews or public events, it is too early to determine whether this dialogue will create meaningful policy change. There are no stringent legal and policy mechanisms requiring the public organizations to consider the feedback, and consequently in many cases policy

makers showed only a symbolic commitment to tackle the issues raised in the civic monitoring reports and avoided taking action. In several cases, the national government only considered using information about interventions with positive results.

4.4. Barcelona Open Data Initiative

4.4.1. Overview of Training Program

The Barcelona Open Data Initiative (Barcelona Iniciativa Open Data) is a civic organization based in Barcelona (Spain) that was co-founded in 2016 by Lourdes Muñoz, a politician working on policy and technology, and Alberto Abella, a researcher and OGD consultant. They aimed to encourage the publication and use of OGD in the context of the metropolitan area of Barcelona, although their area of influence expands to all of Catalonia. As a first step, the co-founders staffed the organization with a group of known OGD champions, mainly public employees working on OGD initiatives and data journalists. They also set up an advisory board that includes activists and representatives from government, universities and research centers, nonprofits, and technological companies.

Barcelona Open Data Initiative offers three types of training activities. The first takes place under the umbrella of the Data Citizen School, a training program to educate citizens in the basic skills and knowledge needed to use and make sense of OGD. Its goals are to empower citizens in the use of OGD, to offer training tools for personal development in OGD, and promote knowledge. The two-hour workshops are free and cover topics such as the value of OGD, licenses, data quality, OGD platforms, and OGD formats. Although these workshops target average citizens, participants are usually students that are exploring new topics and areas of interest.

The second training program targets OGD professionals, such as public employees working with OGD, developers, and data journalists. It includes several four-hour modules on different topics, such as legal aspects of OGD, OGD reuse, linked data, and social impact of OGD. Most modules cost 130 Euros. The different modules can be combined in four certificates: two on Open Data Governance (Basic Open Data

Governance and Intermediate Open Data Governance) and two on Business Open Data (Business Professional Open Data and Business Advance Professional Open Data). Some of these modules are certified by the Open Data Institute (ODI) in the United Kingdom (Barcelona Open Data Initiative is a node of ODI in Barcelona).

Finally, the tailored-made training program is being launched at the time of writing. It is designed to meet the specific needs and requirements of the requesting organization. The first training activity has been funded by the Autonomous Government of Catalonia and aims to empower Catalan nonprofit organizations to use its OGD. Among its specific objectives, the Autonomous Government of Catalonia wants to encourage nonprofits to identify data sets that are relevant but not yet open.

Depending on their target audience, different courses emphasize different skills. For example, the course on OGD reuse targets professionals such as data journalists that use OGD as an essential part of their careers, and includes several tools to search, download, and visualize the data. In contrast, the course on portal data targets public employees whose organizations are building OGD portals, and focuses on the process of publishing the data and developing skills such as data validation and data cleansing.

All the workshops and courses use real OGD that are primarily produced by Catalan local and regional governments. Instructors focus on the Catalan data to show that best practices in opening and reusing data can be found in their own context. The specific datasets used can be related to any domain, such as transportation or safety. In addition, instructors also share examples from other geographical areas.

Although training plays a core role in this initiative, promotion of OGD is not restricted to formal training workshops. Several social events are organized on a regular basis to sensitize citizens to open government data principles. These social events are tailored to different goals. The Drinks & Data and Open Data Beers facilitate networking, the Open Data Day aims to improve citizens' awareness of the benefits of OGD, and cross-sector round tables promote discussion on open data-related topics. Despite

its slow start, another significant initiative is the Knowledge Community, a platform bringing together individuals and organizations with an interest in OGD.

4.4.2. Early Outcomes

In less than one year, the Barcelona Open Data Initiative has offered more than 20 courses, with an average of six to ten participants. Key informants perceive that most students do not know anything about OGD when they first join a workshop, but they frequently end up registering for two or more courses. This might be an indicator of students' satisfaction with the workshops and might show that training is somewhat contributing to capacity building. However, there are no course evaluations to systematically assess knowledge and satisfaction and it is too early to assess any economic or social impact or whether students maintain their interest in using OGD.

4.4.3. Challenges

Despite the positive short-term results, there have been three important challenges. The first set of challenges is associated with the start of a new organization. They include economic issues that might jeopardize the sustainability of the project. The course fees are low and several activities are offered for free, given the initiative's goal to raise awareness of OGD in society. Although the fee structure benefits participants, it may not be financially sustainable for the organization. Another challenge has been a slow start to implementing trainings. Second, it has been difficult to find good OGD trainers. Although most of the individuals interested in teaching courses had experience using OGD portals, they are not all experienced teachers, thereby limiting the success of the course. Finally, the most important challenge has been society's lack of interest in OGD, which is reflected in the low current demand for these courses. Although the initiative has tried to disseminate workshop information in multiple formats, from personal relationships to social media, it has been hard to engage citizens and demonstrate the potential value of OGD.

5. COMPARISON AND DISCUSSION

The three cases presented in the previous section of the paper constitute promising examples of training programs to promote OGD use among citizens. In this section of the paper we will compare the cases in the light of current challenges and data skills needed to promote further OGD. Tables 1 and 2 summarize the comparison of the three cases for many relevant dimensions, including how they relate to the ODI framework described in section 2.

Table 1. Overview of three open government data training projects

Characteristic	**Future Public Managers**	**Monithon**	**Barcelona Open Data Initiative**
Geographic location	Albany, New York (United States)	Italy	Barcelona (Spain)
Target audiences	Master of Public Administration and graduate certificate students	High school students Citizens Non-governmental organizations	Citizens Professionals (e.g. public employees, developers, and data journalists) Non-governmental organizations requesting tailored workshops
Current coverage	All students from one university's graduate program (almost 70 students to date)	Approximately 6,000 students from over 400 public schools across Italy from 2014 to 2017 About 50 higher education students from the University of Turin and 30 students from the LUISS University in Rome 25-30 citizens participated in the first civic monitoring school in Sibari (Calabria region)	Approximately 20 courses, with an average of six to ten participants per class
Organization responsible for training	University at Albany (public university)	Several organizations (e.g. national government and Action Aid)	Barcelona Iniciativa Open Data (civil society organization)
Instructional methods	Six-week face-to-face module within a semester-length course, using in-class activities, homework, and examinations	High school students: six-month blended course with online content and face-to-face in-class activities and homework Citizens and non-governmental organizations: similar format but compressed timeline (from four days to three months)	Data Citizen School: two-hour workshops Certificate program: four-hour modules Organizations: customized 35-hour face-to-face training program, over several weeks Public awareness activities, such as Drinks & Data, Open Data Beers, Open Data Day, and Knowledge Community
Fees for participants	Requires tuition of $1,800 or $3,700 depending on whether student is a state or out-of-state	Free	Free workshops and public awareness activities 130 Euros for certificate program

	resident		18,000 Euros for customized training program
Data sources	Health Data NY (New York's statewide open health data portal) HealthData.gov (United States federal open health data portal)	OpenCoesione (Italy's federal OGD portal) Other data specifically related to the public investment under investigation	Any OGD available on Catalan regional and local OGD portals
Content domains and datasets	Domain: health Most activities use New York's hospital discharge and restaurant inspection data Supplemental activities use New York's environmental data to compare metadata between the state and federal data portals	Domain: government expenditures Students select one European Union-funded project for detailed analysis	Domain: based on student interest Teachers select specific datasets within different content areas

Table 2. Comparison of skills, early outcomes, and implementation of three open government data training projects

Characteristic	Future Public Managers	Monithon	Barcelona Open Data Initiative
Skills covered from Open Data Institute framework	Introduction Analysis Leadership	Introduction Analysis Leadership	Introduction Analysis Publishing Management Business Leadership
Unique training program strengths	In-depth training and activities tailored to the skills students need for their careers Focusing on two datasets across six weeks allows for in-depth analysis	Use of massive open online course (MOOC) increases accessibility Wide coverage, particularly among young students	Multiple training formats, including specialized courses for specific organizations, can accommodate diverse needs
Challenges of training program implementation	Audience currently limited to graduate students from one program in a single university, with low incentive to broaden into a more accessible MOOC format Training requires user fee, making it inaccessible to broader public Structured format using two datasets has lower appeal to students interested in non-health domains	Timid commitment from government officials Limited information about how policy decisions were taken and about the results of the interventions Complexity of local governance makes it difficult to identify the responsible actors Financial sustainability	Low demand Questionable sustainability of the project No formal evaluation of students' ability to use OGD once they have finished the courses

All three cases focus primarily on introductory knowledge and uses of OGD. Moreover, when the programs include skills in the areas of analysis, leadership or management, they still approach these skill sets in a basic introductory way. For example, analysis skills cover basic data cleansing, organization, and visualizations using basic spreadsheet software such as Microsoft Excel. All cases focus on the introduction and analysis skills from the ODI framework, although Iniciativa Barcelona Open Data also includes an opportunity for additional advanced courses in all other areas of the ODI framework. We believe this case's alignment with the ODI framework is the result of the partnership between the Spanish organization and ODI. Further, all three cases show that it is not enough with being aware of

open government data. In addition to introduction skills, focused on getting familiar with OGD and with creating value of OGD, real use depends on additionally having, at least, analysis skills.

Another finding from these cases is that beyond these important introduction and analysis skills, different types of users have unique knowledge needs that require specific additional training. In the Monithon case, NGOs need leadership skills to influence policy change. Public employees in the Barcelona Open Data Initiative receive training on publishing OGD, as these skills are requisite for their tasks as data providers.

However, the cases also suggest a possible skills gap in the ODI framework: the ability to ask meaningful questions about specific public policy problems, identify ways to answer the questions using data, and report findings from the analysis. We argue that this set of skills is related to the development of social capital and therefore also to the skills required to interact with diverse actors (such as governments, policy makers, or the media). These skills are particularly important for researchers, data journalists and data activists that use OGD to promote change or to recommend policy solutions. This is highlighted in the Monithon case, where program participants are particularly interested in investigating the impact of a specific project, submit reports to the government, and expect reactions to such reports in the form of new policy decisions. To help the Monithon students be successful, the program also teaches them how to gather additional qualitative data to better understand OGD in a specific context. The Future Public Managers case addresses these skills through the policy memo assignment, which requires students to synthesize the data meaningfully for an executive leader and provide policy recommendations based on the data analysis. The Barcelona Open Data Initiative's tailored course for NGOs also emphasizes strategies to communicate and interact with the regional government, in order to increase the future use of OGD. The positive student feedback from that aspect of the training curricula, combined with the observation that all three training programs explicitly addressed this skill set despite evolving independently, suggests that this set of competencies should be added to the ODI framework.

One area where all cases were successful was recognizing the need to tailor the trainings to the needs of the users. Although some core competencies such as locating, downloading, and cleansing data are universal and can be taught in any program, there are important differences between users and uses of open data that require local adaptations of these generic skills. For example, high school students studying the impact of a local infrastructure investment may need additional training on basic civics to understand the context, public administration graduate students need to learn how to manage data in software programs that will likely be available in public agencies and nonprofit organizations, and the students in the Barcelona Open Data Initiative's tailored training required additional skills in data publication. Using a framework can be useful to ensure coverage of each skill category, but promoting OGD use effectively also requires understanding the users and expected uses of OGD and subsequently tailoring the training curricula and activities to build specific skills.

Finally, all three cases experienced challenges that are consistent with the ones found in previous literature regarding the use of OGD. For example, the Barcelona Open Data Initiative's struggle to find appropriate instructors resonates with the more general challenge of limited human resources which all sectors developing the OGD enterprise have experienced (Barry & Bannister, 2014; Graves & Hendler, 2014; Martin, 2014). Another important challenge consistent with the literature is associated with data quality (Martin & Begany, 2017a; Martin et al., 2017; Safarov et al., 2017). This is most evident in the case of Monithon, where program participants found incomplete information to analyze the impact of EU funding and subsequently required gathering additional primary data for their reports. In the Future Public Managers case, the instructors took advantage of data quality limitations and used it as a pedagogical tool to help students learn how to properly inspect data, evaluate potential biases, and describe data limitations in reports. While many students found the process of understanding and managing imperfect data to be useful for their professional development, some expressed dismay that they could not trust data.

A final challenge faced by OGD training programs is finding sustainable business models. Sustainability is critical to give users opportunities to improve their skills over time and to continue to train new users as OGD platforms expand and publish data that would be relevant to broader audiences. The Barcelona Open Data Initiative struggles to collect enough funding to continue with its mission. Its fee-for-service model is insufficient given the current low interest in OGD use which has resulted in low enrollment. Also, Monithon shows difficulties to find financially sustainable models, not only to continue developing national tools and methodologies, but also to spread the use of its methods to a wider audience. Only the training of high school students is currently covered by government funding through the project "A Scuola di OpenCoesione", carried out by the government itself. However, this type of funding is contingent to changes in government executive leadership and the funding may erode under different elected officials, making it not exactly the most sustainable form of funding. Embedding the OGD training in a formal academic curriculum, as in the Future Public Managers case, is more sustainable because it has both infrastructure (such as paid instructors, classroom space, and a mechanism to collect revenue) and funding (in the form of tuition). However, its format limits its impact to a relatively small number of students annually, and the university's tenure and promotion guidelines offers faculty few incentives to transform the course into a MOOC or develop an open-source textbook that could be used by a broader audience.

6. CONCLUSIONS AND FUTURE WORK

The OGD literature has established that OGD skills and engagement of diverse users are critical barriers to broader use. However, there is limited empirical research on interventions to train citizens and professionals and actively encourage their use of OGD. The main objective of this article was to start the conversation on open data training and its potential contribution to increasing use of OGD by analyzing three diverse training programs aimed at building data skills and fostering awareness and use of OGD.

Preliminary results suggest that participants in the cases: 1) enjoy the opportunity to work with real-world data, 2) learn new data skills, mainly focused on introduction and analysis, 3) are surprised about the vast array of government data and its production, 4) gain confidence in transforming raw data into summarized information and communicating findings to diverse audiences, 5) appreciate the challenges of presenting quantitative findings accurately and preventing the risks of data misuse, and 6) are more equipped to critically evaluate existing analyses. At the same time, each program encountered unique challenges such as coverage, selecting data topics with broad appeal, commitment from government officials, and sustainability.

Through our description and comparison of the training projects, we can draw three general conclusions. First, we find that introduction and analysis skills need to be taught in combination to encourage use of open data. Being aware of what OGD is and its benefits is not enough to promote use. Second, training on OGD seems to be more effective when complemented with knowledge about context and interactions with government. The ODI framework should potentially be expanded to also include general skills on how to make the data useful in relation to the users' interests. Finally, it is critical to embed the training interventions in the specific contexts and tailor the content to the particular characteristics, interests, and expectations of different types of users. In this respect, exploring users' motivations to enroll in training programs as well as investigating the correlation between those motivations and the different challenges encountered could be interesting areas for further research. In addition, it would also be worth investigating the relationship between specific users' needs and the associated skills in the training (i. e., the content of the training programs).

Having established that these training programs are both feasible and can be adapted to local contexts, we have not yet found any long-term evidence of impact in terms of increasing use of OGD. Although we coined them "preliminary outcomes", impact of the different initiatives was reported in terms of outputs (such as number of participants or number of courses) and satisfaction measures rather than in

terms of increasing OGD use. Indeed, given our findings, we can only conclude that OGD training is a *sine qua non* condition to increase OGD usage. Yet, training alone may not necessarily result in increasing OGD use. Therefore, an important direction for the field of OGD is to evaluate systematically the short- and long-term impacts of these training programs in more detail. For example, experimental studies could assess the most effective instructional methods to deliver content, the types of topics and datasets that are most successful at fostering curiosity and a lasting interest in using OGD, and how to make these trainings sustainable. An in-depth understanding of training effectiveness and strategies will be useful to tailor training programs to different audiences and contexts. In addition, further research could look into the combination of strategies (training programs among them) that are needed to effectively increase OGD use.

As OGD platforms and their data offerings continue to evolve, engaging new users and breaking down their barriers to use are critical to unlocking the full value of these data.

7. REFERENCES

Atenas, J., Havemann, L.,& Priego, E. (2015). Open data as open educational: Towards transversal skills and global citizenship. *Open Praxis, 7*(4), 377-389.

Baldwin, C. (2014). Using Public Sector Open Data to Benefit Local Communities. *Computer Weekly*, 17–20.

Barry, E., & Bannister, F. (2014). Barriers to open data release: A view from the top. *Information Polity*, *19*(1,2), 129–152. https://doi.org/10.3233/IP-140327

Begany, G. M., & Martin, E. G. (2017, May). The OPEN Government Data Act: What's at Stake? Retrieved May 31, 2017, from http://www.rockinst.org/observations/martine/2017-05-10_martin.aspx

Berners-Lee, T. (2009). Linked Data. Retrieved August 21, 2013, from http://www.w3.org/DesignIssues/LinkedData.html

Bria, F., Gascó, M., Baeck, P., Halpin, H., Almirall, E., & Kresin, F. (2015). *Growing a social digital innovation ecosystem for Europe*. Brussels: European Commission.

Chan, C. M. L. (2013). From Open Data to Open Innovation Strategies: Creating E-Services Using Open Government Data (Vol. 0, pp. 1890–1899). Presented at the 46th Hawaii International Conference on System Sciences (HICSS-46), IEEE Computer Society.

Dawes, S. S., Vidiasova, L., & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly*, *33*(1), 15–27. https://doi.org/10.1016/j.giq.2016.01.003

Gil-Garcia, J. R., Pardo, T. A., & Luna-Reyes, L. F. (2017). Policy Analytics: Definitions, Components, Methods, and Examples. In J. R. Gil-Garcia, T. A. Pardo, & L. F. Luna-Reyes (Eds.), *Policy Informatics*.

Grant, C. (2016). Supporting a Passion for New Ideas through Open APIs. *Information Services & Use*, *36*(1/2), 65–72. https://doi.org/10.3233/ISU-160798

Graves, A., & Hendler, J. (2014). A study on the use of visualizations for Open Government Data. *Information Polity*, *19*(1,2), 73–91. https://doi.org/10.3233/IP-140333

Harrison, T. M., Pardo, T. A., & Cook, M. (2012). Creating Open Government Ecosystems: A Research and Development Agenda. *Future Internet*, *4*(4), 900–928. https://doi.org/10.3390/fi4040900

Helbig, N., Cresswell, A. M., Burke, B. G., & Luna-Reyes, L. F. (2012, November 30). *The Dynamics of Opening Government Data*. Working Paper, Center for Technology in Government, The Research Foundation of State University of New York. Retrieved from http://www.ctg.albany.edu/publications/reports/opendata

Hjalmarsson, A., Johannesson, P., Juell-Skielse, G., & Rudmark, D. (2014). Beyond innovation contests: A framework of barriers to open innovation of digital services. Presented at the Twenty Second European Conference on Information Systems, Tel Aviv. Retrieved from http://bada.hb.se/bitstream/2320/14330/1/0211-file1.pdf

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, Adoption Barriers and Myths of Open Data and Open Government. *Information Systems Management*, *29*(4), 258–268. https://doi.org/10.1080/10580530.2012.716740

Janssen, M., & Zuiderwijk, A. (2014). Infomediary Business Models for Connecting Open Data Providers and Users. *Social Science Computer Review*, *32*(5), 694–711. https://doi.org/10.1177/0894439314525902

Khayyat, M., & Bannister, F. (2015). Open data licensing: More than meets the. *Information Polity: The International Journal of Government & Democracy in the Information Age*, *20*(4), 231–252. https://doi.org/10.3233/IP-150357

Lyon, F., Gyateng, T., Pritchard, D., Vaze, P., Vickers, I., & Webb, N. (2015). Opening access to administrative data for evaluating public services: The case of the Justice Data Lab. *Evaluation*, *21*(2), 232–247.

Marshall, C., & Rossman, G. B. (2011). *Designing Qualitative Research*. SAGE Publications.

Martin, C. (2014). Barriers to the Open Government Data Agenda: Taking a Multi-Level Perspective. *Policy & Internet*, *6*(3), 217–240. https://doi.org/10.1002/1944-2866.POI367

Martin, E. G., & Begany, G. M. (2017a). Opening government health data to the public: benefits, challenges, and lessons learned from early innovators. *Journal of the American Medical Informatics Association*, *24*(2), 345–351. https://doi.org/10.1093/jamia/ocw076

Martin, E. G., & Begany, G. M. (2017b). Transforming open government data into all-star data. Rockefeller Institute of Government Blog, August 2017. http://www.rockinst.org/observations/martine/2017-08-10_martin.aspx.

Martin, E. G., Birkhead, G. S., & Helbig, N. (2015). Opening health data: what do researchers want? Early experiences with New York's open health data platform. *Journal of Public Health Management and Practice*, (5), 1.

Martin, E. G., Law, J., Ran, W., Helbig, N., & Birkhead, G. S. (2017). Evaluating the Quality and Usability of Open Data for Public Health Research: A Systematic Review of Data Offerings on 3 Open Data Platforms. *Journal Of Public Health Management And Practice: JPHMP*, *23*(4), e5–e13. https://doi.org/10.1097/PHH.0000000000000388

Martin, S., Foulonneau, M., Turki, S., & Ihadjadene, M. (2013). Risk analysis to overcome barriers to open data. E*lectronic Journal of e-Government, 11*(1), 348 -359.

Miller, S. (2016). Preparing the next generation for the cognitive era. *Information Services & Use*, *36*(1/2), 23–25. https://doi.org/10.3233/ISU-160804

Ohemeng, F. L. K., & Ofosu-Adarkwa, K. (2015). One way traffic: The open data initiative project and the need for an effective demand side initiative in Ghana. *Government Information Quarterly*, *32*(4), 419–428. https://doi.org/10.1016/j.giq.2015.07.005

Patton, M. (2002). *Qualitative evaluation and research methods.* Newbury Park: Sage.

Puron-Cid, G., Gil-Garcia, J. R., & Luna-Reyes, L. F. (2016). Opportunities and Challenges of Policy Informatics: Tackling Complex Problems through the Combination of Open Data, Technology and Analytics. *International Journal of Public Administration in the Digital Age*, *3*(2), 66–85.

Reggi, L., & Dawes, S. (2016). Open Government Data Ecosystems: Linking Transparency for Innovation with Transparency for Participation and Accountability. In *Electronic Government* (pp. 74–86). Springer, Cham. https://doi.org/10.1007/978-3-319-44421-5_6

Ruijer, E., Grimmelikhuijsen, S., & Meijer, A. (2017). Open data for democracy: Developing a theoretical framework for open data use. *Government Information Quarterly*, *34*(1), 45–52. https://doi.org/10.1016/j.giq.2017.01.001

Safarov, I., Meijer, A., & Grimmelikhuijsen, S. (2017). Utilization of open government data: A systematic literature review of types, conditions, effects and users. *Information Polity*, *22*(1), 1–24. https://doi.org/10.3233/IP-160012

Scapens, R. W. (1990). Researching management accounting practice: The role of case study methods. *The British Accounting Review*, *22*(3), 259–281. https://doi.org/10.1016/0890-8389(90)90008-6

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks: Sage.

Styrin, E., Luna-Reyes, L. F., & Harrison, T. M. (2017). Open Data Ecosystems: An International Comparison. *Transforming Government: People, Process and Policy*.

Susha, I., Grönlund, Å., & Janssen, M. (2015). Driving factors of service innovation using open government data: An exploratory study of entrepreneurs in two countries. *Information Polity: The International Journal of Government & Democracy in the Information Age*, *20*(1), 19–34. https://doi.org/10.3233/IP-150353.

Tygel, A. F., & Kirsch, R. (2016). Contributions of Paulo Freire to a critical data literacy: A popular education approach. *The Journal of Community Informatics, 12*(3), 108-121.

Wirtz, B. W., Piehler, R., Thomas, M.-J., & Daiser, P. (2016). Resistance of Public Personnel to Open Government. *Public Management Review*, *18*(9), 1335–1364. https://doi.org/10.1080/14719037.2015.1103889

Yang, T.-M., & Wu, Y.-J. (2016). Examining the socio-technical determinants influencing government agencies' open data publication: A study in Taiwan. *Government Information Quarterly*, *33*(3), 378–392. https://doi.org/10.1016/j.giq.2016.05.003

Yin, R. K. (1994). *Case Study Research Design and Methods*. Newbury Park, CA: Sage.

Zhang, J., Luna-Reyes, L. F., & Pardo, T. A. (2016). Information, Policy, and Sustainability: The Role of Information Technology in the Age of Big Data and Open Government. In J. Zhang, L. F. Luna-Reyes, T. A. Pardo, & D. S. Sayogo (Eds.), *Information, Models, and Sustainability: Policy Informatics in the Age of Big Data and Open Government* (pp. 1–19). Heidelberg: Springer.

Zubiaga, A., & Mac Namee, B. (2016). Graphical perception of value distributions: An evaluation of non-expert viewers' data literacy. *The Journal of Community Informatics, 12*(3), 138-159.

Zuiderwijk, A., & Janssen, M. (2014). Open data policies, their implementation and impact: A framework for comparison. *Government Information Quarterly*, *31*(1), 17–29. https://doi.org/10.1016/j.giq.2013.04.003.

Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R., & Alibaks, R. S. (2012). Socio‐technical Impediments of Open Data. *Electronic Journal of Electronic Government*, *10*(2), 156–172.

Zuiderwijk, A., Janssen, M., & Davis, C. (2014). Innovation with open data: Essential elements of open data ecosystems. *Information Polity*, *19*(1,2), 17–33. https://doi.org/10.3233/IP-140329.

Zuiderwijk, A., Janssen, M., & Susha, I. (2016). Improving the speed and ease of open data use through metadata, interaction mechanisms, and quality indicators. *Journal Of Organizational Computing & Electronic Commerce*, 26(1/2), 116-146.

Mila Gascó-Hernández holds a MBA and a Ph. D. in public policy evaluation (Award Enric Prat de la Riba granted to the best Ph. D. thesis on public management and administration, given by the Escola d'Administració Pública de Catalunya in Barcelona, Spain). Nowadays, she is the Associate Research Director of the Center of Technology in Government as well as a Research Associate Professor at the Rockefeller College of Public Affairs and Policy, both at the University at Albany – SUNY. Before joining SUNY, Dr. Gascó served as a senior researcher at the ESADE's Institute of Governance and Public Management and the Institute of Innovation and Knowledge Management, in Spain. Previous to that, she was a senior analyst at the International Institute on Governance of Catalonia and a professor in the Rovira Virgili University the Pompeu Fabra University.

Mila Gascó has a lot of consulting experience on the information and knowledge society as well. In this respect, she has worked for a wide variety of organizations such as the United Nations Development Program, the Mayor's Office in Valencia (Venezuela), the Spanish Agency for International Development Cooperation, the City Council and the Provincial Council of Barcelona, the International Institute for Democracy and Electoral Assistance, the Latin American Centre on Management for Development (for whom she co-developed the Ibero-American Interoperability Framework), the World E-Governments Organization of Cities and Local Governments (she was the leading judge for the WeGo Awards), the Inter-American Development Bank, or Google.

Her areas of research are mainly related to ICT adoption by the public sector and, among other, they include electronic and open government, e-governance public sector innovation, smart cities, and public policy evaluation.

Erika G. Martin is Director of Health Policy studies at the Rockefeller Institute of Government and Associate Professor of Public Administration and Policy at the University at Albany in Albany, NY. She holds a Ph.D. in Health Policy and Administration from Yale University and a M.P.H. in Epidemiology from University of Michigan. She uses mixed methods to evaluate issues related to the allocation of scarce public health resources, the adoption and impact of public health policies, and how public health agencies can release open data in formats that are more usable and fit for public health research and practice. She has published articles and commentaries in an array of leading health and public policy journals including the *New England Journal of Medicine*, *Journal of the American Medical Association*, *Health Affairs*, *American Journal of Public Health*, *Journal of the American Medical Informatics Association*, *Public Administration Review*, and *Journal and Policy Analysis and Management*. She has served on a National Academy of Medicine committee on data systems to monitor HIV care outcomes, and was the staff writer of a report to the U.S. Secretary of Health about how to maximize the value of HealthData.gov.

Luigi Reggi is an ICT public policy analyst with experience in the fields of Digital Government and Open Government. Currently, he serves as a policy advisor at the Italian National Agency for Territorial Cohesion, responsible for coordinating the implementation of European Structural and Investment Funds in Italy. He is one of the founders of Monithon, a civil society initiative promoting the civic monitoring of EU-funded projects. He is also a PhD student in Public Administration and Policy - Government Information Strategy and Management concentration - at the State University of New York at Albany. He has authored international academic papers and research reports on digital government services diffusion and quality, ICT governance at the local level, open government strategies, European policy.

Sunyoung Pyo is a doctoral student in Public Policy at the University at Albany and holds an MPA in public administration. She is currently on leave from the Korean police force. Her research interests are on crime policy and Police discretion.

Luis F. Luna-Reyes is an Associate Professor of Public Administration and Policy at the University at Albany in Albany, NY. He holds a Ph.D. in Information Science from the University at Albany, and he is also a member of the Mexican National Research System. He is also a Research Fellow at the Universidad de las Americas Puebla. Luna-Reyes is one of the top 20 digital government researchers world-wide. His research focuses on electronic government and on modeling collaboration processes in the development of information technologies across functional and organizational boundaries. His research interests are related to areas such as inter-organizational collaboration, open government data, information sharing, success of government-wide web sites, and information policy. He is the author or co-author of articles published in Government Information Quarterly, Public Management Review, European Journal of Information Systems, Information Polity, Gestión y Política Pública, System Dynamics Review, and Information Technology and Management among others.