

Open Government Data: Applications for Sustainability

Master Thesis submitted in fulfillment of the Degree

Master of Science

in Sustainable Development, Management and Policy

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Vienna, 9 June 2014

AFFIDAVIT

I hereby affirm that this Master's Thesis represents my own written work and that I have used no sources and aids other than those indicated. All passages quoted from publications or paraphrased from these sources are properly cited and attributed.

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ABSTRACT

Beginning in 2009, President Barack Obama introduced the Open Government Data (OGD) initiative, an approach to usher in a new form of government characterized by increased transparency, collaboration, and public participation. Through this OGD initiative, governments release to the public their raw datasets spanning a wide range of domains. Especially at the local city level, governments are encouraging businesses and individuals alike to create mobile and web-based applications from this raw data. Currently however, much of the attention of governments, researchers and businesses focuses on the potential uses for these OGD applications and their economic and business implications.

This master thesis complements the state of the art understanding of the implications of the OGD phenomenon by examining the ways in which current OGD-based applications are being used based upon economic, social, and environmental sustainability. This thesis also investigates ways these applications might extend themselves to be more useful to these sustainability efforts in the future. A taxonomy across these three pillars of sustainability was created to categorize current applications in both Vienna and New York City and focus groups were carried out in these two locations to explore the experiences of actual users. Additionally, these focus groups helped provide useful recommendations for general characteristics OGD-based applications must exhibit to be successful in the future. Creators of OGD-based applications in Vienna were also surveyed to determine their motivations behind creating these applications. Drawing upon these multiple methods, it was concluded that there are ample opportunities for OGD-based applications to support all three aspects of sustainability. Furthermore, as a side effect of the performed analysis, a suite of general recommendations for the extension of these applications were derived, including: increased awareness of the initiative and applications among citizens; creating well-functioning applications and ensuring the accuracy and reliability of the data once it is in application form; as well as the diversification of channels for communication and networking among all stakeholder groups.

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LIST OF ABBREVIATIONS

EPA – Environmental Protection Agency (United States)

GHG – Greenhouse Gas

GMO – Genetically Modified Organisms

OGD – Open Government Data

WKW – Wirtschaftskammer Wien (Chamber of Commerce, Vienna)

1 INTRODUCTION

1.1 Context and Previous Research

The formal open government data (OGD) initiative started by President Barak Obama in 2009 kicked off what is hopefully a new era in government. This new era hopes to be one characterized by increased accessibility, transparency, and public participation. As governments make raw datasets available to the public, there has been a push by these governments especially at the local level, for individuals to transform these raw datasets into useful applications on mobile or web-based platforms. As this new initiative continues to take shape, new possibilities for the purpose and usage of these individual applications are being explored. Currently however, the research available regarding the potential uses for OGD is mostly focused on the economic and business implications of this data and applications. This master thesis closely examines the ways in which these current applications are being used based upon economic, social and environmental sustainability as well as in which ways these applications might extend themselves to be more useful to these sustainability efforts in the future.

1.2 Research Aims and Objectives

Research Question: How can Open Government Data be used and extended to foster efforts for sustainability especially in urban settings?

In order to answer this overarching research question, four sub-questions will be investigated:

1. *How are Open Government Data applications currently being used to support sustainability?*

Beyond the stated goals of the open government data initiative, it was important to look more closely at the applications which have already been created, using Vienna, Austria as a sample city. As this study was interested especially in how these applications might be used for sustainability, it was essential to identify how the current applications are spread over economic, environmental and social sustainability.

2. *Are sustainability specific OGD applications currently being used differently between Vienna and New York City?*

While Vienna has an excellent catalog of open government data applications, New York City was chosen as a second city for comparison of their current applications. As the open government data initiative officially began in the United States and has spread worldwide, this comparison highlighted differences in the current uses for the applications between these two cities.

3. *How are current and potential users of Open Government Data applications experiencing them? What ideas for extension do they have?*

In addition to identifying and categorizing the applications which are made available to the public in each of these cities, it was also significant to investigate the ways in which actual users experience these applications. While creators may be able to create a wide range of applications from these datasets, the users must see them as adding value to their lives in these cities, and a useful tool worth expanding in the future.

4. *Is there a clear sustainability intent behind creating applications?*

Drawing from a concurrent study being performed by the author and two additional students at Modul University Vienna, the motivations of OGD based application creators themselves were investigated. This additional information gathered directly from the creators of these OGD applications helped to highlight gaps which may exist between the purposes as outlined by either governments or users and the creators.

1.3 Methodology and Key Outputs

Each of the four research sub-questions carries its own method for obtaining information as well as a specific desired output. To answer first two sub-questions regarding how OGD applications are currently being used to support sustainability, a taxonomy to categorize the applications in both Vienna and New York City was created. This taxonomy was then applied to all OGD applications in both cities, resulting in visualizations depicting how these applications are currently spread over economic, environmental, and social sustainability. Comparing the visualizations for both cities illustrated some differences and similarities across these two locations. For the third sub-research question, experiences of actual users were investigated through focus group discussions in both Vienna and New York City. Participants in these focus groups were also asked to imagine ways in which these OGD applications might expand in the future. An analysis of these group discussions was performed across multiple relevant subjects. Finally, the fourth sub-research question concerns the motivations and intentions behind the creators of these OGD applications. To answer this question, a short survey was sent to the creators of Vienna's applications. The results of this questionnaire were analyzed and compared to both the main goals of the OGD initiative as well as experiences and desires of users. An overview of these methods and outputs is illustrated in Figure 1.

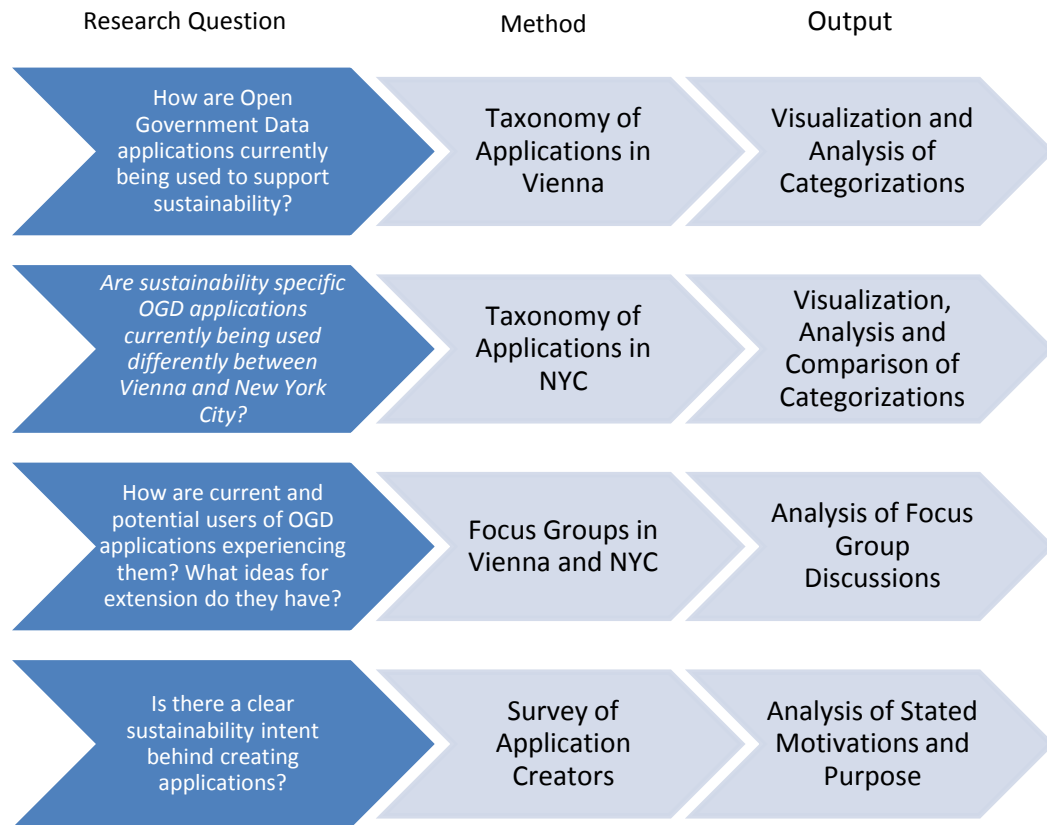


FIGURE 1: OVERVIEW OF METHODOLOGY AND KEY OUTPUTS

1.4 Structure of the Thesis

This thesis is divided into seven chapters.

Chapter 2 is a review of the relevant literature which helps provide background information and clarification of the key concepts. This review of literature is further broken down into sections covering both Open Government Data and Sustainability.

Chapter 3 outlines the methodology employed for this research study.

Chapter 4 is a discussion of the results of the taxonomy categorization created for the study.

Chapter 5 is a discussion of the results of the focus groups in Vienna and New York City

Chapter 6 is a discussion of the results of a survey sent to creators of OGD applications in Vienna, in conjunction with a study project with the Wirtschaftskammer Wien (WKW)

Chapter 7 contains conclusions drawn from the entire study as well as implications for stakeholders and suggestions for further research.

2 LITERATURE REVIEW

2.1 Theoretical framework

The key concepts of this master thesis are Open Government Data, web and mobile applications, as well as social, environmental, and economic sustainability. The open data sets are provided by government bodies which are then made available on public platforms as raw data sets. These raw data sets are then used to create web and mobile applications which aim to make the data more usable to the public. Creators of these datasets include a number of stakeholders including government bodies, non-governmental and non-profit organizations, for-profit organizations, individuals or groups of individuals. Many of these applications are specific to the city for which they were created, using local government data sets and creating applications to assist local residents and tourists as they visit a particular city. Most applications can then be categorized by their primary purposes into the three main pillars of sustainability: social, environmental, and economic. These three categories both alone and in combination can lead to increased sustainability within these urban settings at both the individual and collective level. As these applications are used by individuals, they may help shape their habits and lifestyles and lead to more sustainable urban societies. Figure 2 illustrates these key concepts and stakeholders.

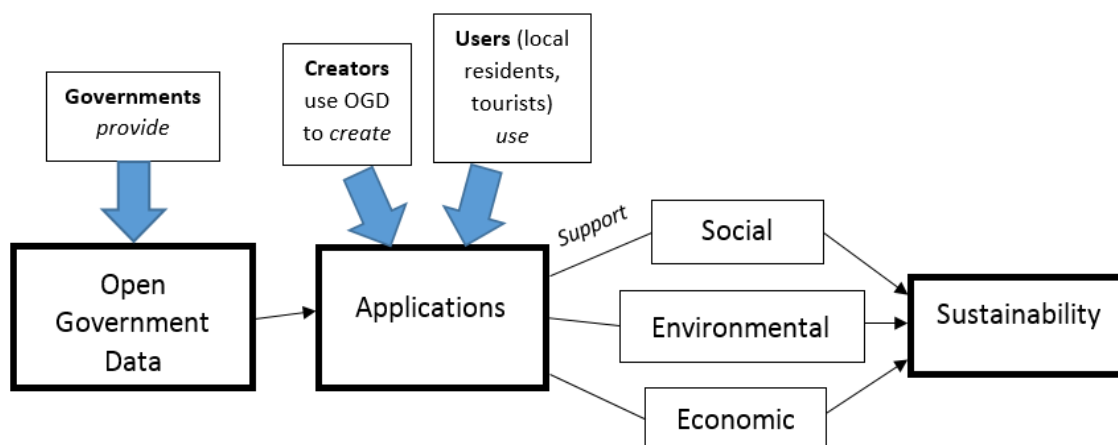


Figure 2: Illustration of Key Concepts and Stakeholders

2.2 Open Government Data

2.2.1 History of Open Government Data

Our present bureaucratic government was formed as a result of the expansion of the industrial economy. It became increasingly necessary to create more complex structures, processes and controls as both the size and revenue of government increased. This complex system of procedures operated within a framework which mostly supported a vertical flow of information, rather than one horizontally shared between different departments and organizations (Tapscott, 2010). As technologies advanced, computing was applied to the work of governments in a similar way to corporations. The same processes and procedures were used, just now using software to help carry out some of these tasks. This increased technology usage actually made these bureaucracies more complex rather than streamlined, as now new stakeholders were required to help plan and operate these digitized processes (Tapscott, 2010).

The concept of e-government is not a new one, but has evolved through several stages to where it is today. Beginning with the first evidence of a digital presence in government, the purpose of this stage was simply to provide information to citizens online without any interaction between the two parties. The second stage moved to provide a platform for some simple interaction such as email or interactive forms between governments and citizens, businesses and other agencies. Services allowing for online transactions characterized the third stage in this evolution. These first three stages are grouped together and referred to as Government 1.0, with the bulk of information flowing only from government to the public with only very limited feedback mechanisms from citizens and businesses themselves (Chun et al., 2010). As governments are now beginning to enter the fourth stage, and beginning of Government 2.0, they are finding ways to use online tools to change how the government itself operates. This fourth stage is a move towards a more seamless information flow between the two groups fostering more collaborative decision making and promoting shared governance among various stakeholders (Chun et al., 2010). Government 2.0 is a shift from the traditional view of government being the all-knowing authority which is the creator and organizer of this vast body of information and citizens are merely consumers of the information to an approach involving all stakeholders in a collaborative knowledge-sharing network (Chun et al., 2010). This new stage of innovation in government is an opportunity to fundamentally change the way government operates and engages its citizens and how citizens interact with their governments (Tapscott, 2010). As Tim O'Reilly (2010) points out though, Government 2.0 should not be seen as an entirely new form of government, but rather the existing government structure brought back to its basic elements and redesigned.

In order to help usher in this Government 2.0, on his first full day in office in January 2009, President Barack Obama wrote a memorandum regarding transparency and Open Government addressed to the Heads of all Executive Departments and Agencies. In this memorandum

Obama (2009) stated that they all must “work together to ensure the public trust and establish a system of transparency, public participation and collaboration”. He continued by remarking that “openness will strengthen our democracy and promote efficiency and effectiveness in Government” (Obama, 2009). Based upon President Obama’s memorandum outlining these top line goals for a more open government, an official directive was released in December 2009 which sets out more specific steps for each government department and agency to follow. The broad categories for these steps include publishing government information online and improving the quality of this government information as well as creating and institutionalizing a culture of Open Government and creating and enabling policy framework for Open Government to be successful (Orszag, 2009). Davies and Lithwick (2010) state that “the agency Open Government Plans probably represent the largest single coordinated effort by the federal government to make itself more transparent, participatory and collaborative.” By the end of 2009 several other countries including Australia, the United Kingdom and New Zealand had all made official announcements regarding their own initiatives for the proactive disclosure of data (Davies & Lithwick, 2010).

Obama’s announcement as well as the official Open Government Directive are all consistent with the Freedom of Information Act (FOIA) which states the types of records and information government agencies are required to proactively disclose and not wait for specific orders to do so (Davies & Lithwick, 2010). In May of 2009 the United States Government launched data.gov which makes economic, environmental, health care and other data available for the public in a variety of electronic formats. The site also provides descriptions of the available data sets as well as instructions for how to access the data itself and the tools that will ultimately help citizens make use of the data. These data catalogs are continuously growing as new data sets from a number of agencies are added (Davies & Lithwick, 2010).

2.2.2 Goals and Principles of Open Government Data

As previously stated, the overarching goals of the entire Open Government movement are to increase transparency, participation and collaboration between governments and citizens. In a broad sense, as Douglas Schuler (2010) outlines in his chapter on online deliberation and civic intelligence, the world is now experiencing increasingly complex and difficult problems ranging from climate change to war and terrorism. The societal response to these issues must come from a position of collective intelligence for these common challenges. No individual citizen or government will be able to tackle these problems alone, and the way societies are able to successfully harness this civic intelligence will determine the successfulness of the response. If Open Government is successfully implemented it could potentially improve this civic intelligence and our democracy overall while still managing to keep costs at acceptable levels by harnessing much of this new intelligence from citizens rather than paid government employees. This new era of civic intelligence will not be characterized by bigger or smaller govern-

ment, but will instead alter the nature of governance as well as the interactions of governments and their citizens to be a more effective system (Schuler, 2010 and Sifry, 2010).

In December of 2007, a group of thirty advocates of open government worked together to create a set of principles of Open Government Data which could be applied worldwide (Malmud et al., 2007). The eight principles are outlined in Table 1 and these same basic goals can also be found on the Austrian site for open data (data.gv.at, 2014).

TABLE 1: OPEN GOVERNMENT DATA PRINCIPLES

1. Complete	All public data is made available. Public data is data that is not subject to valid privacy, security or privilege limitations.
2. Primary	Data is as collected at the source, with the highest possible level of granularity, not in aggregate or modified forms.
3. Timely	Data is made available as quickly as necessary to preserve the value of the data.
4. Accessible	Data is available to the widest range of users for the widest range of purposes.
5. Machine Processable	Data is reasonably structured to allow automated processing.
6. Non-discriminatory	Data is available to anyone, with no requirement of registration.
7. Non-proprietary	Data is available in a format over which no entity has exclusive control.
8. License-free	Data is not subject to any copyright, patent, trademark or trade secret regulation. Reasonable privacy, security and privilege restrictions may be allowed.

Having this set of accepted defining characteristics helps to ensure the uniformity of open government data initiatives as they spread worldwide. These principles also help all relevant stakeholders fully grasp what truly open data is. While the aspects of accessibility and non-discriminatory are included in this list, it is not merely having access which satisfies the principles of open data. This data must also be complete and up to date, directly from the source. With data being released at the source, there is a smaller likelihood the data will have been tampered with or otherwise made incorrect by either human or technical error. These principles also speak to the format of the data, which again helps to normalize how the data will be presented in its raw form. Datasets must be available in an open format, which is not subject to any licenses or regulations and must be able to be processed by a machine in the future. It is possible this list would evolve in the future as both the initiative and technology evolves, but

this set of principles should provide an adequate framework of the initial intentions of the open government data movement.

2.2.3 Open Government Data in Practice

With these stated goals of the open government data initiative in mind, the results and activities of the initiative in practice are still evolving. Benefits to the open government data initiative can already be seen from both the government perspective as well as the individual citizen. Individuals are now better able to participate in combining data from multiple agencies to customize the data to meet their needs (Ding, et al., 2011). Citizens are also able to share these helpful combinations, patterns, and applications with others as well as provide direct feedback to the government agencies themselves. This process is in turn reducing costs to governments as they are able to release raw datasets which have already been collected rather than spend the time and energy to create usable reports or applications themselves (Ding, et al., 2011). While the data does need to be transformed into usable applications at some point along the chain, it will be important for infrastructure to be put in place which spreads this task to various stakeholders helping to insure the practical usage of datasets (Ding, et al., 2011).

2.2.4 Open Government Data Websites

Open government data can be found worldwide, ranging from large, trans-national datasets to much smaller regional and local levels. Figure 3 below illustrates the current reach of this initiative based on which countries currently host open data websites worldwide. Following Figure 3 is a review of some major OGD websites, namely for Vienna, New York City, the United Kingdom, and the United States. This highlights the contrasting situations across countries as well as between the national and local levels.



FIGURE 3: COUNTRIES WITH OPEN GOVERNMENT DATA SITES (DATA.GOV, 2014)

OGD Website for Vienna: The Viennese applications from open government data are contained on a single website which covers all of Austria. Raw datasets as well as the final applications are listed on this site with the ability to filter the lists based on a number of factors including location, keyword, and format. The number of applications is still constantly growing, as of May 2014 there are over 1,200 datasets and 141 applications for Vienna out of the total 233 applications for all Austrian location. A screenshot of the main homepage as well as the search page for the raw dataset catalog can be found in Figure 4. (data.gv.at, 2014)

offene Daten Österreichs – lesbar für Mensch und Maschine

Vielfalt, Transparenz, Offenheit, Demokratie

data.gv.at bietet einen Katalog offener Datensätze und Dienste aus der öffentlichen Verwaltung, welche auf den Open Data-Prinzipien basieren.

Sie können diese Daten frei nutzen – zur persönlichen Information und auch für kommerzielle Zwecke wie Applikationen oder Visualisierungen. Details hierzu finden Sie im Menüpunkt **Netiquette**.

Mehr Hintergrundinfos erhalten Sie auch im Video **„Was ist Open Data?“**

Welche Daten sind verfügbar?
Die österreichische Verwaltung bietet alles von Wetterdaten bis zu genauen statistischen Daten aus allen Ressorts und Verwaltungsebenen.

Was kann man damit machen?
Die Daten stehen im Rahmen der Open Government Data frei zur Verfügung. Genaue Datenreichtlinien erfahren Sie bei den einzelnen Datensätzen.

Was tut sich im Bereich OGD?
Aktuelle zu Innovationen, Veranstaltungen, Zusammenarbeit, Technologie, Anwendungen im Bereich der Offenen Daten in Österreich.

Wer steckt dahinter?
Die Kooperation OGD Österreich aus Bund, Ländern und Gemeinden, die mit data.gv.at eine Plattform für offene Daten aus der Verwaltung anbieten.

Katalogsuche

Suchbegriff (z.B. Finanzen, Wahlen) Sie können dieses Feld auch unbenutzt lassen und ausschließlich mit den Filtern arbeiten.

Filter

Suchergebnis (1230 gefunden) Seite 1 von 82

Titel	Veröffentlichende Stelle / Datenverantwortliche Stelle	Veröffentlicht auf data.gv.at am	Letzte Änderung	Format
Stationen - Standorte Station, Standorte in öffentlichen Krankenhäusern, Wien	Stadt Wien / Wiener Krankenanstaltenverbund	11.04.2012	02.06.2014	wfs, csv, gml, json, shp, wms, rss+xml, gfi, jpeg, kmz, kmz, png, png, wms, gfi, jpeg, png, png
Kirchen und Religionsgesellschaften Gesetzlich anerkannte Kirchen und Religionsgesellschaften - Standorte, Wien	Stadt Wien / Ökumenischer Rat der Kirchen in Österreich	12.12.2013	02.06.2014	wfs, csv, gml, json, shp, wms, rss+xml, gfi, jpeg, kmz, kmz, png, png, wms, gfi, jpeg, png, png
Kindergärten - Standorte Kindergärten, Standorte, Wien	Stadt Wien / MA 10 - Wiener Kindergärten	11.04.2012	02.06.2014	wfs, csv, gml, json, shp, wms, rss+xml, gfi, jpeg, kmz, kmz, png, png, wms, gfi, jpeg, png, png, html
Wahllokale, Abstimmungslokale und Annahmestellen - Standorte	Österreichische Bundeswahlverwaltung			wfs, csv, gml, json, shp, wms, rss+xml, gfi,

Figure 4: Screenshot of OGD Website for Austria (data.gv.at)

OGD Website for New York: New York City hosts its over 3,400 datasets on one website, nycopendata.socrata.com, which allows for users to search the entire catalog of raw datasets by categories. Applications for New York City are spread out over multiple online sites and platforms, resulting in a less straightforward collection of what is available. One official site for applications and APIs (Application Program Interface) is found through the NYC Developer Portal (developer.cityofnewyork.us) which highlights 21 different applications. The majority of these applications are either created by city government agencies or are previous winners of the NYC BigApps contest. Since 2009, NYC BigApps has been an opportunity for creators to use the open government datasets and enter their applications into this annual competition. Prizes are awarded across a series of categories such as jobs and economic mobility; energy, environment, and resilience; and healthy living as well as a grand prize winner, which in 2013 was eligible for a \$60,000 prize (nycedc.com, 2013). While a list of past winning applications is available on the BigApps competition website, many of these applications are linked to websites which have been taken down since the competition ended, making it difficult to find some of these applications if they do still exist.

OGD Website for the United Kingdom: (data.gov.uk) The open government data portal for the United Kingdom hosts over 18,000 datasets and 338 applications. Users of this site have the option of filtering the many applications by category, sector, or assigned keyword tags, as well as the ability to search by keyword. The combination of these search options helps make an otherwise potentially overwhelming number of applications accessible to even a casual user.

OGD Website for the United States: (data.gov) The national data portal for the United States government contains over 105,000 datasets which can be filtered and searched based on a wide variety of factors. These factors range from the organization providing the data sets to the topics covered to the format of the data itself. While the site does include links to a number of applications, it does not intend to be an exhaustive list of all applications which have been created from these datasets. There are 341 applications highlighted on the site, however these are simply listed and must be scrolled through with no tool for searching or filtering these applications. As some of these applications use local data rather than federal datasets, not all applications are applicable to all visitors of the site, but may help provide ideas of successful local applications which can be re-created for additional cities. Data.gov also contains a complete list of all open data sites, as well as a visualization of participating states and nations, both in the United States and around the globe.

Table 2 below provides a summary of the number of available datasets and applications for each of the four locations highlighted in this chapter.

TABLE 2: SUMMARY OF AVAILABLE DATASETS AND APPLICATIONS



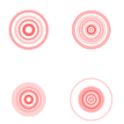



Location	Number of Datasets	Number of Applications
Vienna (data.gv.at)	1,230 (<i>includes all Austria</i>)	141 (<i>only Vienna</i>)
New York City (nycopendata.socrata.com)	3,434	21 (<i>highlighted by website</i>)
United Kingdom (data.gov.uk)	18,437	338
United States (data.gov)	105,606	341 (<i>highlighted by website</i>)

2.2.5 Applications from Open Government Data

To provide an illustration of the range of mobile and web applications which have been created from open government data, Tables 3 and 4 highlight a few sample applications from the test cities in this study.

The majority of applications in Vienna are visualizations of various open datasets overlaid on city maps. Location data from the user is often also integrated in order to improve the navigation experience. A single application may correspond to only one dataset such as *Wann aufs Amt?*, or may layer multiple datasets to provide a more comprehensive application such as the *48er-App*. Several applications including *Play Zone* also combine this open government data with aspects of social media, endeavoring to create connections between users of the application. While some applications use very specific data which would be almost exclusively used by residents, such as waste and recycling locations or average waiting times in district offices, many applications are also geared towards tourists, such as *Story Hunter*. These tourist-friendly applications include the location of many points of interest including museums and historical buildings, as well as hiking routes and events in the city. Several applications including *Willi – Wiener Linien*, help both tourists and residents navigate Vienna's public transportation system. A few applications showcase true creativity and innovation in their uses of these datasets. One such application, *Fruchtfliege*, uses the Vienna tree registry data set in order to identify fruit trees which are publically accessible. Users are then able to apply filters based on fruit or time of year to locate where and when the fruit will be ripe on these trees for picking.






TABLE 3: SAMPLE APPLICATIONS - VIENNA


 <p>48er-App</p>	<p>Created by MA48 (Department of Waste Management), displays location of waste and recycling locations in the city as well as information regarding waste pick-ups.</p> <p>Datasets Used: Dog waste bag dispensers, Public toilet facilities, Mobile household hazardous waste collection, Trash collection – Locations, Recycling collection - Locations</p>
 <p>Story Hunter</p>	<p>Designed for both residents and tourists of Vienna who want to know more about the city than normal tourist attractions. Tells stories of lesser known locations. Also serves as a map highlighting various facilities.</p> <p>Datasets Used: City Bike – Locations, Fundbox – Locations, Multimedia stations, Public Wi-Fi Locations, Attractions – Locations, Drinking Fountains – Locations, Public toilet facilities</p>
 <p>Wann aufs Amt?</p>	<p>Visualization of average waiting times by weekday and time for the municipal district offices in Vienna. (Web application)</p> <p>Datasets Used: Waiting times in the municipal district offices in Vienna</p>
 <p>Play Zone</p>	<p>Helps parents coordinate play-date meetings at family friendly parks or locations. Combines with social media tools to find friends spontaneously or schedule in advance.</p> <p>Datasets Used: Playgrounds - Locations</p>
 <p>Willi – Wiener Linien</p>	<p>Comprehensive public transportation application. Provides location of stops, route planner, and real-time departure information.</p> <p>Datasets Used: Wiener Linien – Real-time data, Stops - Locations</p>
 <p>Fruchtflye</p>	<p>Shows location of publically accessible fruit trees in Vienna. Searchable by fruit and by seasonal ripeness.</p> <p>Datasets Used: Tree register (City of Vienna)</p>

Applications from the open datasets in New York City vary with regards to their themes covered and levels of complexity and user participation. Several city government departments have created official applications, many of which provide identical information and tools that

are available on their websites, only in mobile form. Unlike Vienna, New York City's developer portal for applications hosts few applications which consist solely of open dataset information transposed over a map of the city. One application which has been endorsed by the office of the Mayor, *NYC Way*, includes over sixty datasets and aims to make all single use applications unnecessary by being an all-in-one application for residents and tourists alike. The majority of applications however, combine open data with other online tools or information to create more complex functionality. An example of one such complex application, *596 Acres*, uses the registry of city-owned vacant lots and provides a social platform for neighbors to connect with each other to bring life back to these lots. Many previously vacant lots are now being used by nearby residents for growing food or providing space for community education programs.

TABLE 4: SAMPLE APPLICATIONS NEW YORK CITY

 NYC Buildings	Official application provided by the New York City Department of Buildings. Includes information and search features from website in a mobile application form.
 Appetition	Helps users create, support and promote location-based petitions (street repairs, bike lane reviews, etc.)
 NYC Way	Wide range of information in this all-in-one application. Includes location of museums and cultural centers, volunteer opportunities, Subway stations, WiFi hotspots, Police stations, and traffic cameras.
 596 Acres	Helps neighbors form connections to the city-owned vacant lots near them through maps, signage and online with the aim of growing food and providing educational programs on the lots.
 NextStop NYC Subway	Real-time train information for New York City Subway system. Includes maps and delay notifications and allows users to select favorite stations based on time of day (commuting schedule).

 DemocracyMap	Allows users to look up the different governments to which they belong and learn about their local representatives from local to national level.
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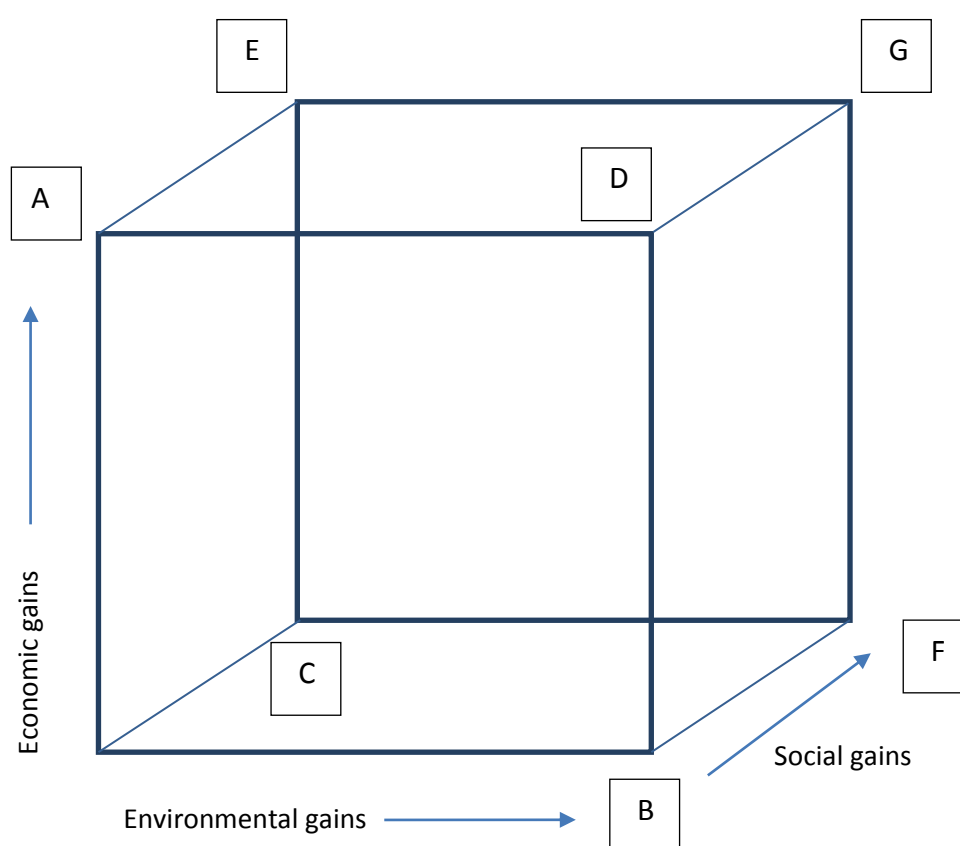
2.3 Sustainability

Our global community is becoming increasingly aware both of the effects our current growth and consumption patterns are having on the natural world as well as the real limits to the natural resource base it is so dependent upon. With these effects and limits in mind, it is essential to find ways for more sustainable living in the future. In the broadest sense, sustainable development can be described as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WECD, 1987). Broken down more specifically, sustainable development integrates a balance between three main pillars: social, economic, and environmental. The social pillar “relates to human mores and values, relationships and institutions” (Baker, 2006) while the economic “concerns the allocation and distribution of scarce resources” (Baker, 2006). The final pillar, environmental, describes the effect that actions in both the social and economic arenas have on the natural environment. Development which is sustainable then looks for combinations and trade-offs to incorporate these three pillars by valuing social justice and reimagined economic practices while still being mindful of the ecological limits of the earth (Rydin, 2008).

As these natural resources are a finite base which must be shared by all, sustainable development can only be truly successful when the focus switches from the progress of the individual to that which allows for the more common development of everyone (Baker, 2006). Historically, many development endeavors have accepted the over-extraction or degradation of environmental resources as an acceptable side effect of societal advancement. Conservation and responsible usage of natural resources helps to ensure both current and future generations will be able to meet their own needs, the absence of which causes instability within society at both the individual and collective level (Baker, 2006). Making these appropriate trade-offs and decisions will require great participation, innovation, and sacrifice from a wide range of stakeholders at all levels. Based on these requirements, increased participation from both the public and private sectors across a wide variety of industries is a key to making these sometimes difficult choices and constraints essential to sustainable development (Achterberg, 1993 and WECD, 1987).

Sustainability in Cities

The World Health Organization reports that currently over half of the global population lives in urban areas, and this number is continuously increasing (WHO, 2014). As we look to formulate sustainable solutions around the world for future development, cities will play a defining role in how our communities operate and shape behavior on both the individual and collective levels. While policies regarding sustainable development may be created and imposed on a national or even supranational scope, the majority of the required changes themselves will occur within the single household, factory, or organization (Rydin, 2008). Just as trade-offs and difficult decisions must be made between each of the three pillars of sustainability on a global scale, the same holds true for the more local level. Figure 4 below illustrates what the results of some of those trade-offs look like when applied to cities.



Vision of the City	Urban Policy emphasis on...
A – The Green City	Visual amenities, green spaces, reducing local pollution and reclaiming derelict land.
B – The Limited City	Reducing resource inputs, increasing recycling and aiming towards self-sufficiency.
C – The Just City	Social equity and social inclusion from urban regeneration.
D – The Ecologically Modernized City	Identifying win-win scenarios for environmentally-friendly local business.

E – Socially Responsible Local Economic Development	Ensuring urban economic development provides social benefits.
F – The Environmentally Just City	Reducing inequalities in the impact of environmental burdens and risks.
G – The Sustainable City	Finding win-win-win scenarios.

FIGURE 5: CONCEPTUALIZING THE SUSTAINABLE CITY (RYDIN, 2008)

As this table and accompanying figure illustrate, cities are not simply labeled as sustainable or not based on their practices, but rather the combination of trade-offs they employ may define them in a number of ways. For example, a city may decide that it values social justice and equity over environmental or economic gains, and therefore allots many of its resources towards these social measures. Perhaps another city strives to add another layer of economic development to their own social gains, without taking many environmental considerations into account. This would result in what Rydin (2008) refers to as “socially responsible local economic development”. While it is possible for a city to find a balance where all three pillars are equal, it is useful to think of these three elements as sliding scales. A complex relationship exists between the pillars which may result in a myriad of defining visions for the city. At the World Summit on Sustainable Development in Johannesburg, South Africa in 2002, representatives from local governments set forth a series of statements regarding their role in meeting the sustainable development goals for the following decade. A portion of the implementation framework which highlights the importance of progress among all three pillars reads “local governments will work to ensure viable local economies, just and peaceful communities, eco-efficient cities, and secure resilient communities able to respond to the change, while ensuring safe and accessible water supplies and protecting our climate, soil, biodiversity and human health” (WSSD, 2002).

Successful implementation of these new sustainable policies regardless of the pillar it most closely aligns with will require cooperation from a number of stakeholders including the individual citizen. This cooperation may best be fostered at the local level where it is possible for residents to have greater direct access to their government and feel as if they are truly participating in these initiatives (Rydin, 2008). While these local level solutions will help to provide a useful starting point for achieving sustainable goals in the short term, as we progress into the future a better knowledge of how each of these cities connects globally with others will be required (Rydin, 2008).

2.4 Conclusion

Even though there is a body of existing and continually expanding literature covering both Open Government Data initiatives worldwide as well as sustainability in various forms, there is a noticeable lack of literature linking these two concepts. As a collective global society looks for sustainable solutions to a myriad of complex problems, this shift to a more open govern-

ment structure with increased transparency, participation, and collaboration will be invaluable. Therefore this thesis explores the link between open government data and its impact on sustainability.

3 METHODOLOGY

This section explains the methodology and research instruments employed for this thesis. Qualitative methods were used both during the review of relevant literature to gain a better understanding of the research topic as well as while collecting primary data through analysis of the applications and discussions of the focus groups. As this research study aimed to explore and better understand both the current usages of open government data as well as the possibility of extending this usage for efforts towards sustainability, a qualitative method was most appropriate (Creswell, 2014).

Several methods were used in order to answer the four sub-research questions outlined in Chapter 1:

1. *How are Open Government Data applications currently being used for sustainability?*

The method for answering this question was to create a taxonomy of all Open Government Applications in Vienna and how these applications are spread across economic, environmental, and social sustainability. This method resulted in a visualization of how these applications are currently being created within the three pillars of sustainability.

2. *Are these sustainability specific applications currently being used differently between Vienna and New York City?*

To answer this question, the same taxonomy applied to the applications in Vienna was extended to the applications found in New York City. This allowed for an analysis of any differences in purpose between open government data applications found in these two cities.

3. *How are current and potential users of Open Government Data applications experiencing them? What ideas for extension do they have?*

The method for obtaining the answer to this question was conducting focus groups of users in both Vienna and New York City. Through the participants' responses to a series of discussion questions, the resulting analysis showed how users experience these applications and where they see possibilities for extension of their usage.

4. *Is there a clear sustainability intent behind creating applications?*

To investigate the intentions of the creators responsible for developing these open government data applications, a short survey was sent to creators of applications in Vienna using contact information provided by the OGD site. The respondents were asked to identify their main motivations for creating such applications as well as the intended purpose of their application.

3.1 Research Instrument

3.1.1 Qualitative Data: Taxonomy Creation

In order to better understand how Open Government Data applications are currently being created in the two observation locations of Vienna and New York City, an analysis of all current applications was performed. Descriptive characteristics of each application were noted, helping to identify the general purpose of each application. For Vienna, all applications are catalogued on a single open data website (www.data.gv.at) which includes applications for not only Vienna, but all of Austria. While New York City has a similar website (developer.cityofnewyork.us/app) moderated by the city government which highlights certain applications, this is not an exhaustive list of applications available from Open Data. Therefore additional websites were culled in order to get a more complete representation of available applications. Following this collection of information regarding the applications, and based upon the concepts of economic, environmental, and social sustainability found in the literature, the applications were placed into one or more of these three broad categories. This created taxonomy of the applications in both cities helped to highlight similarities and differences between the two locations as well as which pillar of sustainability was more represented than another.

3.1.2 Qualitative Data: Focus Groups

Following the categorization of the applications, in order to gain a better understanding of how the open government data applications are experienced by actual users, focus groups were carried out in both Vienna and New York City. As this exploratory research aims to better understand how users experience these applications and what might be gained from this knowledge for the future of these tools, the groups did not seek to be a representative sample of the greater population. The only requirements for participation in these focus groups was a smartphone user who is a resident of either New York City or Vienna and was willing to test out one or more applications. A total of 15 participants tested both mobile and web applications found in the open data portals of their respective locations. Each participant used one or more applications for a period of 10 to 14 days and was asked to look through the entire catalog of applications in order to be more familiar with the open data initiative in general. Upon completion of this testing period, groups of three to four participants met to discuss their experiences as well as their suggestions for future usage of these applications.

The discussion questions for each group were divided into three large categories to help guide the moderator. While it was not necessary for each individual question to be expressly asked in each group discussion, the moderator could be ensured that enough information regarding each broad section was being discussed. First, participants were asked a series of introductory questions regarding their experience during the testing period. This allowed all group mem-

bers to become familiar with which applications the group experienced as well as general impressions from each group member regarding their enjoyment or difficulties during the process. The second group of questions aimed to uncover participants' general thoughts about open government data applications. These general impressions also included questions regarding previous awareness of the initiative and the applications as well as whether participants felt these applications could successfully meet the stated goals of the initiative. The final section of questions explored participants' feelings towards the applications contributions to economic, environmental, and social sustainability. A portion of the sustainability discussion also included what general characteristics would be required in order to make such applications useful to a wide audience in the future. A list of the guiding questions used during these focus groups can be found in Appendix C.

Focus groups were used in order to allow more interviewer flexibility regarding the discussion questions as well as providing a useful tool for fostering a brainstorming process among the participants. In his *Handbook for Focus Group Research*, T. Greenbaum (1998) argues that focus groups can be most helpful in gathering knowledge about attitudes and opinions regarding specific programs or services. Each group was kept to a small number in order to encourage contributions from all group members and not allow any one participant to monopolize the group time. The focus group discussions were all audio recorded and outlines of each group meeting were created from these audio recordings in order to assist in the later analysis of the discussions. Exploratory research generally only requires a descriptive narrative be created from these discussions, rather than an exact transcript. Transcripts take considerable time and resources to create, without much added benefit to these types of research (Stewart, Shamdasani, & Rook, 2007). The outlines of each of the four focus group discussions are also available in the Appendices.

A scissor-and-sort technique was applied to each of the outlines created. This technique involved identifying excerpts from each discussion which aligned with each other and with the overall research topics (Stewart, Shamdasani, & Rook, 2007). Once these topics were each sorted, it was possible to analyze the range of opinions expressed in each section by the various participants. A summary of these findings can be found in the discussions of Chapter 5.

3.1.3 Qualitative Data: A Survey Among OGD Application Creators

In order to incorporate an additional major stakeholder group, a short survey was sent to creators of open government data applications in Vienna based on the contact information provided by the OGD website. This survey was created by the author in conjunction with a concurrent research study being conducted by a group of three Modul University students for the chamber of commerce in Vienna, *Wirtschaftskammer Wien (WKW)*. The five question survey was sent to the list of creators as of February 2014, and was made available in both English and German. The main goals of this questionnaire were to further investigate the motivations

for creators to make these applications as well as the purpose and domain they identified for their application. A copy of this survey in English can be found in Appendix H.

A link to the survey was sent via email to the list of seventy five unique creators of all Vienna applications and remained open for three weeks with one reminder email sent after week two. While some contact information was outdated or otherwise incorrect on the OGD Vienna site, a total of 30 creators completed the survey in either English or German. The results from the survey were then all translated into English and compiled for analysis as one group.

3.1.4 Secondary Data

Background information covering the open government data initiative was collected from relevant literature, official memorandums, official open government data websites, as well as the catalogs of open data applications found on these sites. This information provided a context for the rest of the study, identifying the history and goals of the initiative as well as illustrating how it is currently used in practice.

Beginning in June 2013, the author and two additional students along with one professor at Modul University began a research study in cooperation with the WKW to investigate the open government data initiative in Vienna. Participation in this research study provided invaluable background knowledge and context for the author when framing the questions to be investigated in this thesis. While that study aimed to specifically identify ways in which this open data could be used for various business models, the process of that study highlighted both the gap and potential for a link between OGD and sustainability.

3.2 Conclusion

Linking both primary and secondary qualitative data, this study used several methods to obtain answers to three identified sub-research questions. The results of the created taxonomy for open government data applications, as well as analysis of the experiences shared by focus group participants across the two study locations provided insights for answering these research questions. When combined, the answers to each individual question delivered conclusions for the initial research question for this thesis.

4 OGD APPLICATIONS TAXONOMY

In order to better understand how Open Government Data applications are currently being used in both Vienna and New York City, a taxonomy was created in order to categorize the applications based on the three pillars of sustainability discussed in Chapter 2. The descriptions of the three pillars outlined by the Environmental Protection Agency (EPA) in the United States (2013) served as a starting point for the taxonomy. These basic descriptions were then modified and expanded upon in order to relate more clearly with the applications themselves.

Generally, applications which fall under the economic sustainability category are those dealing directly with the marketplace. These may include applications dealing with employment, both searching for job opportunities and applications which may help increase productivity within a current employment situation. Economic applications may also help provide more complete information regarding the costs associated with the entire lifecycle of a product or service including those costs associated with natural resources. A wide range of stakeholders from producers to consumers might benefit from the availability of such complete accounting knowledge. An extension of this knowledge would also be any applications which work to reduce this total lifecycle cost, especially with regard to non-renewable resources. Additionally, any applications which help foster the entry of new technologies into the market would fall under this category. These new technologies may hopefully include those which contribute to greater eco-efficiency in cities. Finally, this economic category also describes any application which provides direct incentives for more sustainable behavior. (EPA, 2013)

Applications described by the environmental sustainability pillar first include any applications directly involving the maintenance or protection of the natural ecosystem. This also consists of any applications which contribute to, or report on, the overall quality of air or water as well. Applications which may help reduce environmental stressors are also contained in this category, including any which contribute to the reduction of the effects from pollution, greenhouse gas emissions (GHGs) or genetically modified organisms (GMOs) (EPA, 2013). Environmental innovation is also included in this category, whether in the form of engineering and chemistry or in types of new technologies which promote these environmental goals (EPA, 2013). For the purposes of this study, applications dealing directly with green spaces or tree registries are also incorporated into this category.

The third and final category included all applications which promote development in the sphere of social sustainability. While the nature of these applications in general may lend the majority to be categorized as social in some way, these applications are more specifically defined by additional characteristics. Any applications dealing directly with the promotion of justice are included in this category, as well as those which equip citizens with knowledge and

tools to take action in their community in the form of public participation. Beyond this knowledge and transparency of government or rights issues, this social category encompasses any applications directly promoting education in all arenas. Additionally, applications concerning citizens' health or health services are also included in this social category. Highlighting some of the crossover between the three pillars, those applications dealing with resource security are included in this category as well. In this instance, resource security is the ability for both current and future generations to have access to basic resources such as food, water, land, and energy (EPA, 2013). Finally, applications which promote the development or building of sustainable communities also fall into this social group.

A summary of this taxonomy can be found in Table 5 below.

Economic	Environmental	Social
<ul style="list-style-type: none"> • Jobs • Incentives for Sustainability • Greater Information of Full Lifecycle Costs • Natural Resource Accounting • Reduction of Product Lifecycle Costs • Promotes New Technologies in Market 	<ul style="list-style-type: none"> • Ecosystem Services • Green Engineering & Chemistry • Air and Water Quality • Green Spaces • Reduce Stressors (Pollution, GHGs, GMOs) • Resource Integrity (Minimize Waste, New Technologies) 	<ul style="list-style-type: none"> • Justice • Human Health • Public Participation • Education • Resource Security (Water, Food, Land, Energy) • Sustainable Communities (Development and Planning)

TABLE 5: APPLICATION TAXONOMY OVERVIEW. ADAPTED FROM EPA (2013)

While the taxonomy summarized in Table 5 helped to serve as guidelines for the categorization of these open data applications, it was not meant to be an exhaustive list of what may align with any of these pillars. Likewise, it was also possible for an application to fit into more than one category or none at all.

4.1 OGD Applications Taxonomy for Vienna

For Vienna, a total of 141 applications were categorized. These 141 applications encompass all open data applications for Vienna which are found on the main web portal for the open data initiative in Austria as outlined in Chapter 2 of this thesis. Out of the total 141 applications, 109 fit into at least one pillar of sustainability based on the taxonomy previously described. A visualization of these overall findings can be found in Figure 6, while a more detailed list of all applications may be found in Appendix A.

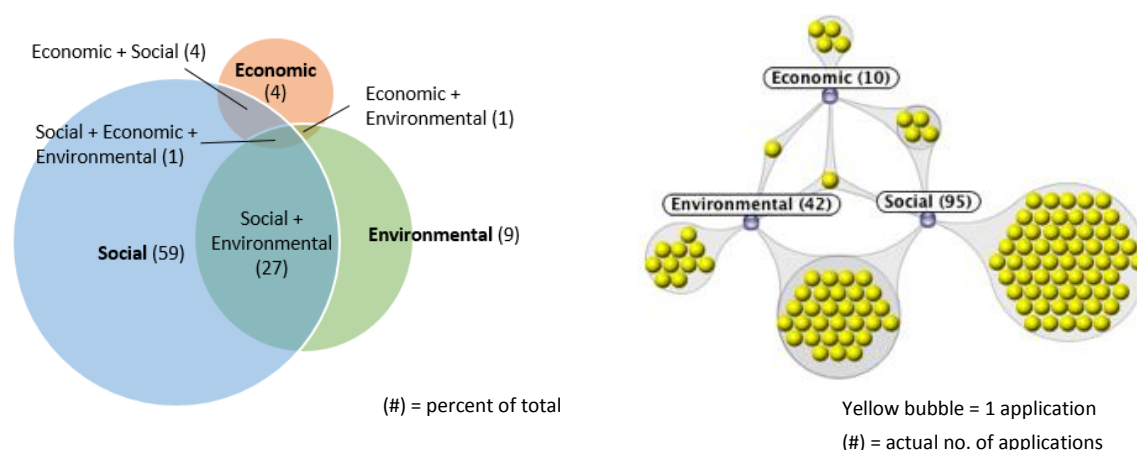


FIGURE 6: VISUALIZATION OF APPLICATION TAXONOMY FOR VIENNA

As Figure 6 illustrates, over 90 percent of the applications which have been created in Vienna at the time of this study fall under the **social** pillar of sustainability including those which fall under more than one pillar. As public participation falls under this categorization and is one of the stated goals of the entire open government data initiative, this particular distribution may be appropriate. The majority of these applications however, seem to be catered more toward sharing the location of various points of interest or service to citizens rather than fostering two-way participation between individuals and their local government. One example of a purely social application is *Ambulanzen in Wien*, which is an interactive map of all outpatient clinics in Vienna with basic contact information and route planning as well as emergency numbers and hospitals.

Similarly, as budget data is released as part of the open data project, the **economic** applications represented here consist mostly of simple visualizations of that data. The application *Budgetvisualisierung* is an example of this type of visualization of Vienna's budget figures. While this information does promote a level of transparency between the government and citizens, these applications are only encompassing a small facet of the possible economic sphere based on this taxonomy.

Likewise, many of the applications which have been categorized as environmental are simply visualizations of green spaces, parks, or tree registries. An example of these **environmental** applications is *Park Finder Vienna*, which uses location data to display the nearest parks to the user. While these visualizations may help promote citizen awareness and involvement in their natural environment, it seems to utilize only a small portion of what could potentially be included in such a category.

Based on this, many of the applications which are at least in some part **environmental** are also **social** in their purposes and therefore bridge the two pillars in this visualization. Some applications such as *PlayZone* combine green spaces with a type of social networking tool in order to meet other nearby residents to use these spaces. Public transportation applications such as

Willi – Wiener Linien and *Öffis* are also included in this environmental plus social group, as they strive to ease not only the experience of citizens or tourists in navigating the city but also potentially reduce environmental emissions by forgoing the use of a personal car or taxi.

Additionally, one Viennese application, *Spinning Circle*, is categorized as **environmental** and **economic**. This application is for a bicycle messenger service which calculates prices based on the distance of delivery within Vienna. Emissions are reduced by using messenger services on bicycles rather than cars, and the application also aims to give complete pricing information of the service to the consumer.

For the **economic** and **social** category, four applications fit this criteria. One application which falls in this group is *Schwimmpreisrechner*. This application uses location data to show the nearest public swimming pool to the user, but has the added component of also ranking nearby pools by their price of admission. The combination of these layers of data assists the user in making a more informed choice without having to look up this information on separate websites or pages.

The one application in Vienna which combines **all three pillars** of sustainability based on this taxonomy is *WienApp*. This complex application provides information about a number of public services offered by the city of Vienna. These services include public transportation, bus stops, bike and taxi locations, and disabled parking locations among others. In addition, this application includes information regarding demographic data for the population and the environment as well as cultural events and other relevant facets of public life.

4.2 OGD Applications Taxonomy for New York City

For New York City, a total of 50 applications were categorized into the taxonomy discussed at the beginning of this chapter. These 50 applications were collected from several sources for the purposes of this study. First, all 21 applications featured under the App Showcase section of the official NYC Developer Portal were included. Most of the applications listed on this main site are those created by various departments of the city government. The remaining applications selected for this research were past winners of the NYC Big Apps competition from 2009 until 2013 across a variety of categories. Unfortunately, several of these applications were created for entry into this competition and have either not been updated or are no longer available. Any applications without clear descriptions or working websites were excluded from this categorization. Of these 50 total applications, 48 fit under at least one pillar of sustainability. A visual representation of the overall categorization can be found in Figure 7 below, with more detailed descriptions of the applications and their categories found in Appendix B.

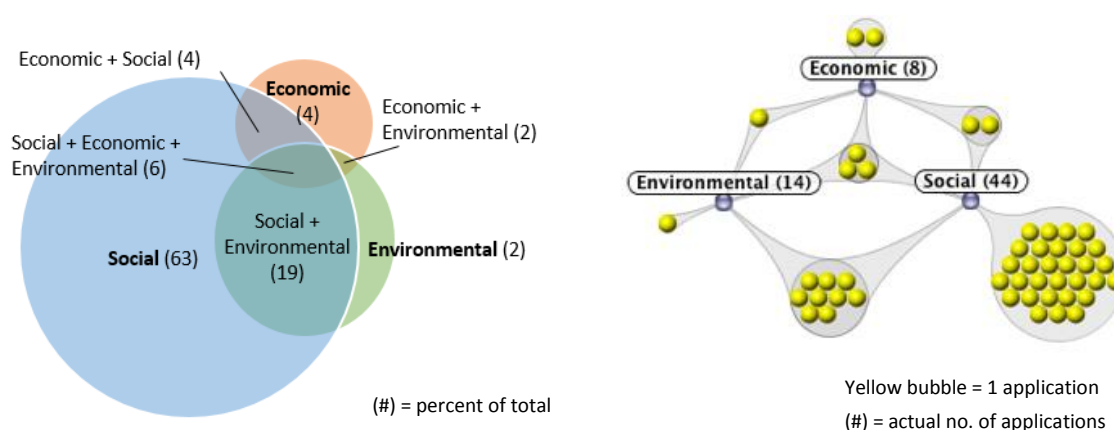


FIGURE 7: VISUALIZATION OF APPLICATION TAXONOMY FOR NEW YORK CITY

As Figure 7 shows, similarly to Vienna, the majority of applications created in New York City fall under the **social** category. With several city government departments such as the Department of Health and Department of Buildings creating their own applications to help increase public awareness and participation, this increased the proportion of socially geared applications. Some of these applications are truly aimed for participation, using two-way feedback portals for ensuring that concerns, complaints, or praises felt by the citizens are heard by the appropriate governing department. The *New York Police Department application* is an example of this two-way participation between users and a department of the city. The application includes information about location and boundaries of police precincts and also provides breaking news and a gallery of wanted persons. Users are also able to submit a tip about a crime to the police directly within the mobile application.

While there are currently fewer applications in New York City overall, many of these applications seem to have moved beyond simple visualizations to much more complex purposes. Perhaps this is a result of many applications being created for entry into a competition and creators are therefore investing more time and resources into the complexity of the solutions they are providing. This trend of moving away from simple visualizations may also help explain the small number of purely **environmental** applications as well, without the inclusion of many green space location applications. The only application which falls under the environmental pillar alone is *Trees Near You* which is a simple display of the city's tree registry data.

One application that falls under the **economic** pillar and is unique to New York City is the *MINY Discount Vendors App*. This application helps entertainment professionals find any of the nearly 1,000 vendors that are participating in the Made in New York Discount program. While the application is available for anyone to download, it is created by the NYC Mayor's Office of Film, Theater, and Broadcasting and the discount program itself is specifically for stage, television, and film projects in NYC.

As residents and tourists of New York City are looking for applications which help navigate a complex public transportation system such as *Embark NYC* or *NextStop NYC Subway*, there are many applications that fall under the **social** and **environmental** categories which serve this purpose. One application that fits into this social and environmental group but does not deal with transportation is *Gardeneers* which merges urban gardening with social networking to help users find existing community gardens or create their own.

Applications bridging the **economic** and **social** categories such as *Urbien* work to create connections between residents through a marketplace setting. This particular application uses elements of both the virtual and real worlds to facilitate micro-entrepreneurship opportunities between neighbors.

The one application which falls under the **economic** and **environmental** category is *ParkAlly*. This application aims to set up connections for parking spots based on time and price in order to reduce circling time for street parking. Users that are currently parked on the street are able to list the time they will vacate the parking spot and users searching for parking spaces are able to bid against each other for the space. One stated goal of *ParkAlly* is to reduce carbon emissions and decrease congestion caused by cars while searching for parking.

Three applications in New York City encompass **all three pillars** of sustainability in their purposes. One such application is *SolarList*, an instant, mobile assessment tool which can be used to calculate the costs and savings of installing solar power cells for individual homeowners. *SolarList* hopes to use this mobile application to train students and young entrepreneurs to go to individual homes and educate homeowners about their solar options. These entrepreneurs will receive financial incentives from a member of the network of installers for successfully referring one of these homeowners.

4.3 Conclusions

Based upon the visualizations created from the taxonomy applied to the open government data applications in these two cities, some immediate similarities became apparent. Both Vienna and New York City had similar percentage distributions across the three pillars and their combinations. In both cities, the vast majority of applications fell under the social category, either alone or in combination with environmental or economic characteristics. While there was a slightly higher representation of purely environmental applications in Vienna based on this taxonomy, both cities had the same percentage of purely economic applications. It is important to note however, that while the applications may fall under similar categorizations in this particular taxonomy, this does not mean the applications themselves were identical.

As previously noted in Chapter 2 with the description of sample applications from these two cities, there were differences regarding the level of complexity of the applications themselves. These differences may also be a result of the volume of applications featured by each city. For

Vienna, the set of applications listed on Austria's open government data initiative site was 141 at the time of this study and continuing to grow. This list included applications which may have been nearly duplicates of others on the list, or at least served similar purposes. It also featured nearly identical single use applications which appear to have been created from a single template and had a number of different datasets applied to them. Because the official New York City developer portal for open data only covered a small number of applications, the additional applications for this study were culled from previous winners of the BigApps competition. It would seem reasonable then that the applications from New York City would be more sophisticated in their purposes for them to have won such competitions. Without other, simpler types of applications being readily available on such sites however, residents of New York City are then left without a similar choice regarding the complexity of applications to use.

5 FOCUS GROUP RESULTS

Four separate focus groups were carried out between Vienna and New York City for the purposes of this study as described in Chapter 3 of this thesis. As previously mentioned, more detailed outlines of each focus group discussion are available in the Appendices of this document. For this analysis section, the contents of the dialogs are organized by the topic being discussed, regardless of which individual focus group the participant took part in. Each focus group conversation was broken down into three thematic segments, beginning with an overview of the participants' experiences during the testing period. This portion then flowed into a discussion of the participants' attitudes toward the open government data applications in general. This general section included opinions regarding the potential effectiveness of open data applications with respect to citizen involvement in cities. Finally, the discussion moved to the future of these applications and their prospective influence on sustainability efforts in these urban settings.

5.1 Focus Group Results for Vienna

Each of the three focus groups in Vienna began with a round of participants sharing which applications they downloaded or viewed and why. The participants downloaded a variety of applications for this study, ranging from more simple location applications highlighting positions of toilets, parks, bike and hiking routes, and waste disposal locations, to transportation and parking information, and even to more complex applications which combine a number of data sets in an attempt to be a more all-inclusive single application. A few participants also chose to download applications that give more detailed narrative information regarding Vienna, such as *Story Hunter*, which even uses location data to alert the user when they are near a point of interest and provide accompanying information and stories regarding this specific location.

While the applications were spread across a variety of purposes, the reasoning identified for the selection of the individual applications was somewhat similar across all participants. At the basic level, many were chosen based on the operating system or language of the application. Nearly all testers indicated their applications were chosen based upon either a desire to get to know Vienna more or to attempt to solve a problem they had identified in order to make their daily lives easier.

General Experience with the Applications

Some participants reported difficulties with the functionality of the applications they downloaded, which may have been the result of either application or user error.

- **Unnecessary** - A few participants reported that they initially downloaded an application which they then found unnecessary or not useful as it only included information they previously knew or could easily find elsewhere.
- **No Internet Connection on Mobile Device** - One tester also shared that because they do not have internet on their mobile device, applications which had no functionality in an offline version were unhelpful.
- **Unable to Locate Applications in App Store** - A couple of the non-Austrian participants had some difficulties locating the applications to download if they were using another country's app store for their mobile device. While this would not affect many residents of Vienna, it may prove to be a barrier for those applications designed specifically with tourists in mind.

One participant summed up this trade-off by commenting that when the applications do work correctly there is a sense of reward to finding these convenient tools, but the opposite can also be true, that when they are not functioning properly the sense of frustration can be high without much willingness to troubleshoot. Generally though, all participants stated that when the applications did work, they enjoyed using them and felt this was a good introduction to open government data applications overall.

Regarding whether they would continue to use these applications in the future, the answers for these specific applications were mixed. While nearly all participants reported good feelings towards the applications in general, some were less sure about the future usefulness of the specific applications they had tested out.

Perception of Open Government Data Applications in General

When asked if they were previously aware of these open government data applications almost all focus group members replied that they were completely unaware. A few members reported being aware of a specific application, but all within a different context and were unaware where the data originated. One participant stated that they were vaguely conscious of the open data initiative but had not looked into or used any of the applications specifically.

Now that they have been made aware of these applications and this initiative, participants were then asked if they would be interested in checking back with the open data portal for new applications as they are developed. The majority said that they would check again, either in Vienna or another city where they may live, while a couple were still hesitant or unsure of the usefulness of these mobile tools in general and indicated they may not look at them in the future. Of those who would check again, one indicated that as a high school educator by profession, they would also look for ways to incorporate such applications into the teaching experience. As the younger generation is increasingly using new technology, these tools might be able to provide an alternative learning experience to traditional methods.

Several respondents were interested in continuing to search for and use applications geared towards helping tourists and residents become more familiar with Vienna as a whole. They reasoned that these applications are a unique and fun way to expand this knowledge without simply searching websites or other information sources for this data. Some participants had specific ideas for topics they would hope to be covered by these applications in the future, including more specific information for recreational facilities and community sports leagues, or potentially even crime rate maps indicating which are the safest parts of the city. The respondent who suggested the crime rate application did admit they were thinking less about Vienna and more about cities in their home country when suggesting such a tool. Noting some duplication among the purposes of applications in the open data portal, one participant added that they would perhaps search for additional applications which are more complex to replace several one-use applications.

During this portion of one of the focus groups, a concern was raised by one member regarding the validity assurance of all included data. They pointed out that while in Vienna there is a certain level of trust and accountability between citizens and the local government, this may not be the case in all countries. Some assurance mechanism might be helpful for users to know that the original data cannot somehow be tampered with during the application making process. As discussed in Chapter 2 of this thesis regarding the general principles of open government data in Table 1, these concerns are also shared by the framers of those principles. These principles include that data should be complete and in the purest form possible, directly from the source without the opportunity to be tampered with. As the entire OGD initiative looks to grow and spread, additional awareness of these measures would be vital to ensuring users have confidence in the information being provided.

Purpose of OGD Applications

Regarding the purposes of these applications, respondents generally felt they should help with everyday life activities and make citizens' lives easier through increased time management and efficiency. Some did agree however, that it would be important to see which activities actually require an application versus what could be solved using common sense without any technological help. These applications should not become an extraneous step simply because they are available. One participant noted that these applications might be especially useful for newcomers to cities to help them become more familiar with city services and activities, with the objective that once this knowledge became routine, the application would no longer be necessary for that user. Again echoed in this section was the usefulness of applications which can display a wide range of information, so that services such as disposal locations for large or specialized items which might only be used a few times per year do not then require their own separate application taking up space on a mobile device. For these cases, simply having information listed on a website would be sufficient.

Recognizing that improved transparency, collaboration, and public participation are the stated goals of the entire open government data initiative, the focus group discussion then shifted to whether these goals are being met by the current catalog of applications. Generally, the answer was that some applications do support these goals, although to varying extents currently. Their very existence might be used as an argument that at least collaboration and participation between the government and application creators has increased, as well as with any users of the applications.

Most participants did agree that even if the current catalog of applications is not exercising its full potential that there is some hope for this to increase along with the future of the initiative. Several respondents observed that in recent years there has been a shift from using desktop personal computers to more mobile devices, including tablets and phones, and along with it an increased familiarity with the possibilities offered by applications on these devices. One participant also noted that evolving technology might also include more widespread internet accessibility, making these applications even more useful to a wider audience who might now be limited by the capabilities of their mobile device. This would also extend to the usefulness of these applications for tourists as well, as currently many tourists or temporary residents must rely on locations providing wireless internet hot spots they can use or the offline functionality of the applications. Another result of this technology evolution are the fun, game-like qualities of these applications with what was previously only available in very simple formats. Users may be more willing to participate in their local government if they are able to get this same feeling through these applications, and this trend may increase as future generations expect similar methods for experiencing their surroundings.

As governments continue to release data sets and citizens become increasingly aware of this transparency and desire for collaboration and participation, several focus group participants envision this relationship strengthening even further. One respondent noted that even the presence of the open government data initiative in the city improved their opinion of the local government. When asked if there is a potential lag or disconnect between what applications the government might hope to be created by the data and what the creators actually do, some participants suggested more visible types of open forums should be created. These open forums would then allow any member of the public to suggest an application even if they lack the technical knowledge to personally create one. While it may still make sense for the government to also commission the creation of applications as they see needs arise, this type of open forum would potentially increase participation among a new segment of the population.

Sustainability and OGD Applications

The final topic for discussion among all of the focus groups was regarding sustainability and the perceived usefulness for fostering these efforts in cities. Each group was asked to think across all three pillars, economic, environmental, and social, and imagine what contributions

these applications could make. Every group began with echoing what the taxonomy confirmed in the section discussed at the beginning of Chapter 4; currently this initiative lends itself mostly to the social pillar. One participant did argue that at the most basic level these applications require mobile devices which run on batteries and must be charged with electricity, so there would be some limit to how truly sustainable they could be. Some participants noted the complexity of the current applications and how some could potentially support efforts in all three pillars simultaneously. One argument was also made that while some of the applications in their current form may not seem to be sustainably minded, their usage by a larger public could have additional effects. The example was given that if enough people used the application which shows the location of publically accessible fruit trees and took fruit from these trees rather than from the store, it could reduce the amount of imported fruit required and have farther reaching environmental impacts than a simple tree registry might suggest. Another example was how a parking application could reduce the time spent circling in a car or trying to find the correct parking location, therefore saving on both fuel and emissions. It was difficult for many participants to envision specific ways these applications might be able to shape more sustainable behavior, but several felt optimistic that with anyone having access to this data, eventually the correct combination of problem solvers and creative minds will find innovative uses.

Extending from both the topic of sustainability and the two-way sharing of information between citizens and government, was whether this shaping of behavior stays mostly at the individual level or if it could be also extended to the collective. One group came to the consensus that attitudes towards this reciprocal data sharing are evolving, and probably will continue to evolve. Users now expect some level of tracking of location or choices in order to improve the service level of online experiences, and will perhaps become even less cognizant of this data collection in the future. One participant also added that as the volume of this data shared by individuals increases, the feeling of being monitored as a single unit decreases. There is a certain anonymity which comes with such a massive scale.

General Characteristics and Recommendations for OGD Applications

Finally, each group was asked to summarize the general characteristics which should apply to all open data applications to make them useful to a wide audience. The main points echoed by all groups were:

- Awareness of the existence of the applications should be increased
- Applications should be easy to use
- Applications should be reliable
- More offline capabilities especially for those applications which are geared towards tourists
- Available in additional languages, or at least in English

- Increase the awareness from tourists by forming partnerships with hotels and tourist offices. This additional promotion may in turn boost the local economy if tourism increases as a result of the improved tourist experience potentially provided by these applications.
- Increased customization features in the applications. While more complex applications which display a wide variety of information are the most useful, being able to isolate the information which is applicable to each user would also be valuable.

5.2 Focus Group Results for New York City

The focus group carried out in New York City began with each participant speaking briefly about the applications they downloaded and their general impressions over the testing period. These applications covered a range of topics, from the location of public drinking fountains or city health services to health ratings at restaurants to more all-encompassing applications. As discussed earlier in this chapter, many of the applications found on the New York City portal for open data are created by city government departments themselves. This was the case with several of these tested applications.

Two of the participants downloaded an application meant to cover a wide array of topics and eliminate the need for multiple single-use applications, although the comments from both participants in this case were somewhat negative. The multiple features of this application were overwhelming to the users and not easily navigated. One participant will continue to use this application for one facet, while the other preferred to delete this application in favor of more simple ones. A positive aspect of this application was that it saved maps and locations even when internet connectivity was lost, which is frequent in New York City whenever using underground transportation.

One focus group member is a high school social worker by profession, and tested an application provided by the city to be a resource to teens about sexual health services. In this case, having an application to explain this information was preferable to referring her clients to multiple websites and other sources of information which might be overwhelming.

Another application chosen by a participant was one of the several applications designed to help navigate the public transportation system. The tester was very pleased with the functionality of this application and its ability to work even without a constant internet connection. It is designed to display the all possible trains and a countdown until the next train is approaching, which can be invaluable to a New Yorker with several options for connections. This is an example of an application which is only useful if the information is correct and quickly accessible.

General Experience with Applications

Generally, all participants enjoyed using the applications they tested. They all echoed similar sentiments though, that these applications make the information more accessible and convenient, but the execution must be flawless for it to be useful. When asked if they were previously familiar with these open government data applications, the response was mixed. One participant had seen the applications advertised on the subway and other areas, but was unaware of the particular applications they downloaded. The other respondents were less conscious of this initiative and the types of data the city keeps record of and now releases to the public. Now being aware of these applications and where to find the catalog, all participants said they would check back with the development of these in the future. As one tester was about to relocate to a new city, they were already searching out the open data portal for that city and what applications might be most helpful as they learn this new location.

Purpose of OGD Applications

Increasing the ease and convenience of city life for residents as well as creating meaningful connections with the city were identified as the main purposes of these applications. The participants agreed that this range of information becoming more centralized and accessible helped to serve this purpose. It was also noted that what is offered in the current catalog seems to only be a small preview of the possibilities the open data initiative might be able to offer, especially in a complex city like New York. One participant specifically hoped for an application providing greater transparency on the sourcing of food in the city, and as this information is regulated they assume it would be possible to find datasets concerning this. This participant would be more interested in the applications expanding in this direction rather than offering additional applications which are purely social.

Sustainability, Public Participation, and OGD Applications

The focus group discussion then moved on to opinions regarding the connection between these applications and public participation. While the participants were slightly unsure of how effective these tools might be, there was an agreement that this initiative increases transparency. Perhaps as more citizens become aware of and use these types of applications it could strengthen relationships between individual citizens and the city and increase involvement. Along with the positive effects of this increased transparency might also be negative outcomes, if it highlights inefficiencies the city is unable to quickly repair.

On a personal level, the participants' responses were mixed. One respondent noted that one of the reasons they do not currently participate in local government is that they perceive it to be too time consuming, but if participation were possible on their phone it might remove this barrier. Another respondent was still unsure however, and noted that outside of voting and

paying taxes they do not feel very connected to their local government and could not think of ways in which an application would bridge this.

Similarly, with regards to sustainability the participants agreed that currently the applications are geared toward more social purposes, although the social aspect could lead to increased involvement in the other two pillars. One participant noted that it might be easier to get citizens involved through connections between all three pillars at once rather than each one individually. It might be possible to use their interconnected nature to promote change in behaviors overall.

General Characteristics and Recommendations

Overall, the participants agreed that several characteristics would be required by any application to be useful to a wide range of users.

- Applications must have a good design and look nice. It was argued that if they look out of date or unprofessional, the validity of the information contained in the application might be questioned.
- Applications should also run quickly, ideally without also taking up too much space on a mobile device. If the applications are not convenient at the most basic level, they will not be used.
- The entire open data initiative and applications should be more greatly promoted. Increased involvement may also lead to increased quality across the range of applications offered.

All participants agreed they would use such applications if they work well and align with a specific interest or solve a particular need.

5.3 Conclusions

It is somewhat difficult to directly compare the focus groups carried out between Vienna and New York City, based upon the differences in the cities themselves as well as the range of applications available in each city. As one focus group member in Vienna noted, it would perhaps be possible to tell a lot about a city based on the range of applications available including what concerns the citizens have and what challenges they face. In New York City it might be much more valuable for a resident to have an application which helps to coordinate transit data to the minute, while in Vienna such precision would not be as crucial. As one of the benefits to open data is that residents can tailor these datasets to be most useful to their own location, these differences in applications are to be expected.

Interestingly however, some of the complaints from the testers in Vienna were that the applications are not yet complex enough, too many are simply visualizations of things that are un-

necessary for anyone who has lived in the city long enough to know these locations. Conversely, some of the issues raised with the New York City applications were how they attempted to cover too many topics in one application, resulting in a very overwhelming user experience. Perhaps there is a comfortable middle ground for this issue, although it may also be quite dependent on the preferences of the individual.

Despite these differences, focus group members in both locations had similar impressions of the open data initiative in general and how it might expand in the future. Nearly all participants had a positive experience testing the applications and were enthusiastic about checking back with the applications as they continue to expand and evolve in the future.

Ultimately the consensus of all focus group participants was that these applications created from open government data can work to increase sustainability efforts in cities. Strengthening the relationships between local government and residents of these cities will be mutually beneficial for both groups. Provided with the appropriate feedback mechanisms, these relationships will hopefully result in increased public participation and assist in the decisions and trade-offs associated with finding sustainable solutions for the future.

Increased public awareness of the OGD initiative and applications

Before public participation can increase however, steps must be taken to increase overall awareness of the open government data initiative and the applications themselves. It would benefit cities to invest some resources into the marketing of these applications or the catalogs in general, perhaps engaging additional partners with shared interests in the applications or users. Especially in Vienna, it would be beneficial to collaborate with hotels and other tourist services to promote applications which would augment the travel experience in the city. For true public participation though, it will be essential to raise awareness of these applications among city residents who will then be able to contribute their own voice to the collective.

Defining characteristics of applications

Along with the increased promotion of this initiative, the applications themselves must have some defining characteristics in order to be useful to citizens. Above all, the applications must function well. As the overall use of mobile applications in all forms rises, so too do the expectations users have for their ease of use. If the applications do not operate correctly, users may not have the patience or desire to troubleshoot solutions to these problems. It will be equally important for the application's data to be accurate and reliable. As many of these applications aim to ease the lives of citizens, if users are unsure of the accuracy of the data itself these tools will lose their credibility as a useful tool. In addition to their usefulness, the applications should maintain an element of fun as well. While these applications should ultimately provide useful, reliable data, a game-like fun quality may encourage users to keep using the application and search out others within the open data project.

Increased communication channels between stakeholder groups

As many current and potential users do not possess the knowledge or skills to create these applications themselves, there may be a disconnection between these two groups. Since the data is now open, anyone can create an application if they are able, but the pool of users with innovative ideas for future applications may be even larger. Forums should be provided for users to post ideas for new applications as well as feedback for current ones, allowing creators to review this information. Increasing communication between these two important stakeholder groups will strengthen the quality of the initiative as a whole and perhaps spur progress in a previously unimaginable direction.

For less sophisticated applications such as location data, it might also be useful for a type of blank template to be created, allowing users to customize their own applications to include the datasets they find most useful. This increased customization could again encourage participation not only in city government but in the open data initiative itself as users become more aware of the range of raw datasets available. On a larger scale, it would also be beneficial to have a medium for sharing experiences with open government data and applications between cities or countries. Especially as they strive to create more innovative applications for these datasets, communicating both best practices and challenges would help to evolve the initiative away from simple visualizations to more sophisticated tools.

6 A SURVEY OF OGD APPLICATION CREATORS IN VIENNA

To better understand the motivation behind the creating Open Government Data applications, a brief survey questionnaire was sent to creators of the applications in Vienna. A contact list of 75 unique email addresses was formed from the data provided by the website hosting all applications. The five question survey was sent out in both English and German versions over a three week period in February and March 2014, and a total of 30 creators responded. The questionnaire responses from both languages were compiled together across both versions and analyzed as a single group. The survey responses also helped to add insight to gaps which may exist between various stakeholder groups. In this case, creator goals and motivations and the stated goals of the OGD initiative could be compared, as well as a comparison between the creators' intended purposes and the users' desires.

While the main open government data website in Vienna does provide some basic information regarding the creators of each individual application, the first question aimed to discover whether the creators of these applications were working alone or as employees of a company or organization. Among respondents, an overwhelming majority of 20 out of the total 30, identified themselves as working as either an individual or group of individuals. The remaining 10 creators reported being an employee at either a for-profit company or an organization (non-profit). None of the respondents selected working as a government employee. It is perhaps impossible to know if this is a representative sample of the group, or if it is skewed towards individuals. Those creators working alone or as part of small groups may have chosen to respond to this particular survey because they possess a personal interest in these OGD applications more so than those creating these applications as part of a job responsibility.

6.1 Main Motivations of OGD Application Creators

The next question asked the creators to identify their main motivations for creating these applications, and respondents were able to select all applicable choices. A graphic illustration of the results of this question can be found in Figure 8. While some options were more highly represented than others, each motivation was selected by at least two survey respondents. "Exploring new technologies" and "facilitating improvement of city life" were each chosen by 19 creators as their main motivations. The next two most selected responses were "hobby" and "gaining personal recognition", each with 14 selections. "Direct financial gain", "creation of a start-up", and "part of a job responsibility" were the least chosen options, with only two respondents each.

While the motivations of creators spread across a wide array of reasons, it is encouraging that "facilitating the improvement of city life" is highly represented. Based on the nature of the

open data initiative and the technological knowledge required to create an application, it seems appropriate that “exploring new technologies” would also be a common answer. Neither direct nor indirect financial gain were identified as motivations among most creators, however some respondents did indicate “gaining personal recognition” as something motivating them. At this early stage of the initiative it is perhaps encouraging to see that creators in Vienna are generally creating these applications based on interest and exploration rather than purely as part of a job or academic responsibility or purely for monetary reward. These motivations could be useful for encouraging participation from creators in discussions about the future possibilities of expansion for these applications in the open data initiative on the whole.

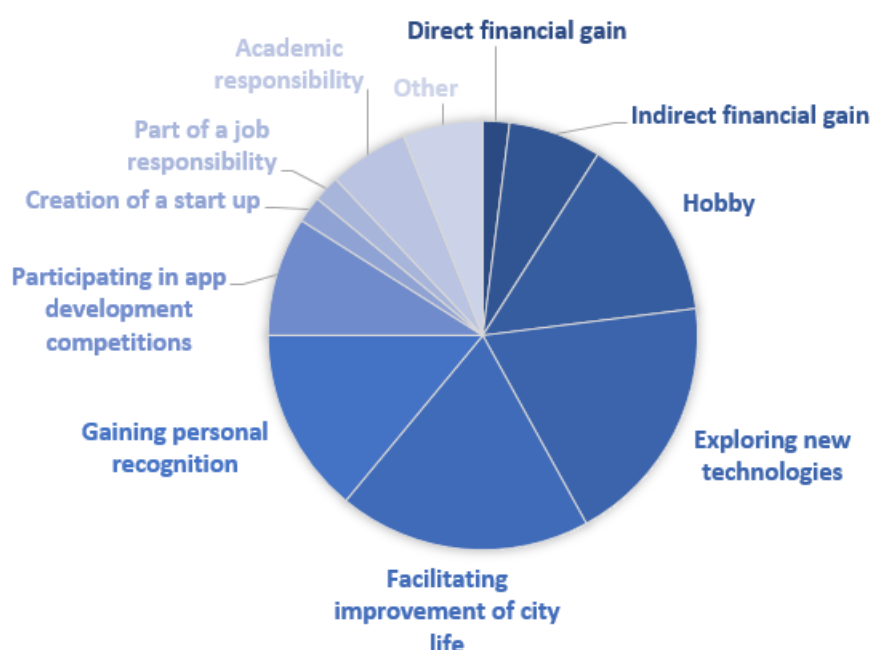


FIGURE 8: CREATOR IDENTIFIED MOTIVATION

6.2 Application Primary Goals and Domains as Identified by Creators

Moving from general motivations to the individual applications, the next question asked creators to identify the primary goal of their application. While again each option was chosen by at least one respondent, the large majority of creators identified “improvement of city life for citizens” as the main goal of their application. The next most popular answer to this question was the “education and empowerment of citizens”. Perhaps surprisingly for these applications as part of the open government data initiative, two of the least selected goals were “government transparency and accountability” and “improvement of government services” although both were selected by more than two creators. The results of this survey question are displayed in Figure 9.

Overall however, these selected primary goals of the applications align fairly closely to the stated goals of the OGD initiative as discussed in Chapter 2 of this thesis. If the overarching goals are transparency, collaboration, and public participation, the only choice in the survey which may not relate to these is the “advertisement of a service”. The least selected goal currently however is “nature care and conservation or environmental sustainability”. This closely aligns with the findings in the taxonomy section, as very few applications could be described as having environmental sustainability as a primary goal or purpose. Even though it was possible for respondents to write in any additional goals they felt would better describe their application than those provided, none chose to do so. These selected goals illustrate the current range of applications and hopefully also indicate some promise for expansion in the future. While not all listed goals are equally represented, the proportion of those outside of the “advertisement of a service” category are encouraging. This distribution may indicate that creators are also looking beyond simply business and economic uses for these applications, and are interested in ways this open data could be used for additional purposes.

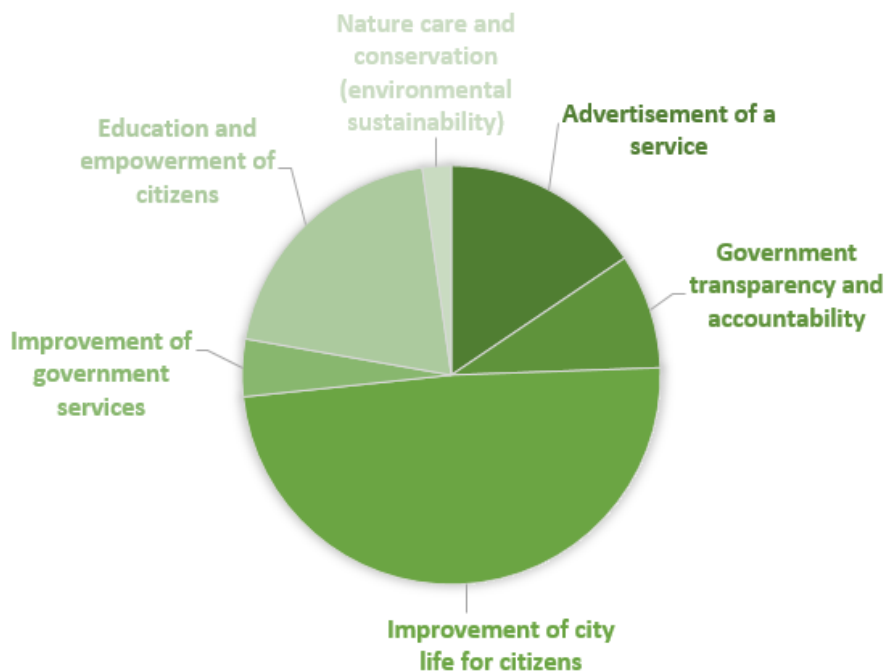


FIGURE 9: CREATOR IDENTIFIED PRIMARY GOAL OF APPLICATION

Application Domains

In order to further understand how the creators intended their applications to be used, the creators were asked to self-identify the domain or domains they thought best described their application. As similarly indicated by the taxonomy categorizations of all open government data applications in Vienna, the most popular domain choice was “location/points of interest” with 16 respondents selecting this domain for their application. Because many of the raw da-

tassets are simply location based information, this may also be the most straightforward way to convert this data to a mobile or web application. “Transportation” follows with 12 creators identifying it as a domain for their application. All other choices follow with seven or fewer selections. The complete results from this question are displayed in Figure 10.

Even with “location and points of interest” currently holding a large proportion of the domains, similar to the primary goals of the applications, there is a wide range of domains being covered overall. As these OGD applications continue to expand in the future, this range of domains is encouraging for the potential reach of the applications in the lives of users. Ideally these applications will provide ways for citizens to interact with their communities in a number of ways spanning multiple aspects of everyday life.

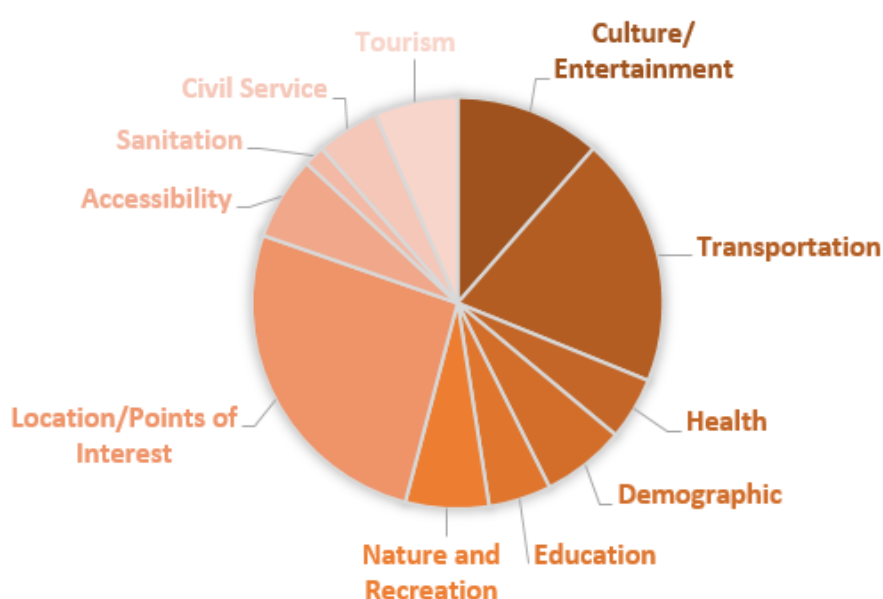


FIGURE 10: CREATOR IDENTIFIED APPLICATION DOMAIN

Application Download Statistics

The respondents were also asked to disclose the number of downloads their application had to date if this number is known. While some are web applications where this information is not applicable, the range of popularity of these applications is evident. The number of downloads ranges from 150 to 180,000 with an average among all respondents of just over 17,500. No further information was provided as to why such a wide discrepancy might exist, although these applications may also vary widely in the length of time since their creation as well as the target audience for the application. Some highly specialized applications may only be useful to a specific number of users, while others are useful to a majority of the population.

The results of this question were also interesting considering the number of focus group respondents who shared that they were unaware of the OGD applications prior to the testing process. These download figures seem to align somewhat with that sentiment, and perhaps with additional campaigns to raise awareness of these applications these numbers would increase. As the initiative continues to grow and expand, it would be useful to monitor these download figures to see which applications are most popular and perhaps also to see how effective any given awareness campaign is able to be.

6.3 Conclusions

Overall, the creators reported being motivated by improving city life and exploring new technologies more frequently than direct or indirect financial gain. These motivations may be vital in the future as creators, users, and governments work together as the three main stakeholders of the OGD initiative to expand these applications in innovative ways. Were the creators mostly motivated by financial incentives, the collaboration between these three groups might be hindered by the availability of economic resources, whereas now there is hope for increased opportunities for communication and brainstorming.

Of the creators who responded to the survey, it appears that their intentions for the purposes of OGD applications align closely with the stated goals of the initiative. Many creators identified goals such as “improvement of city life for citizens” and “education and empowerment of citizens” as well as “government transparency and accountability”. While it would be possible for many applications to serve as an advertisement of a specific service, far fewer creators identified this as the primary goal of their OGD application. Inherently, the advertisement of a service does not have to be contradictory to the OGD goals of collaboration, transparency, and public participation, although this is perhaps the closest to a strictly economic purpose for the application.

The spread of identified domains of these OGD applications seems to mostly line up with the reported experiences by users of these applications in the focus groups discussed in Chapter 5. While many applications in Vienna currently utilize the location and points of interest datasets, others have expanded into multiple facets of daily life. As these applications continue to evolve in the future, reevaluating this array of identified purposes and domains might be a good indicator for how the entire OGD initiative is expanding.

7 CONCLUSION

7.1 Major Conclusions

Figure 11 provides a summary of the main conclusions per each of the four sub-research questions.

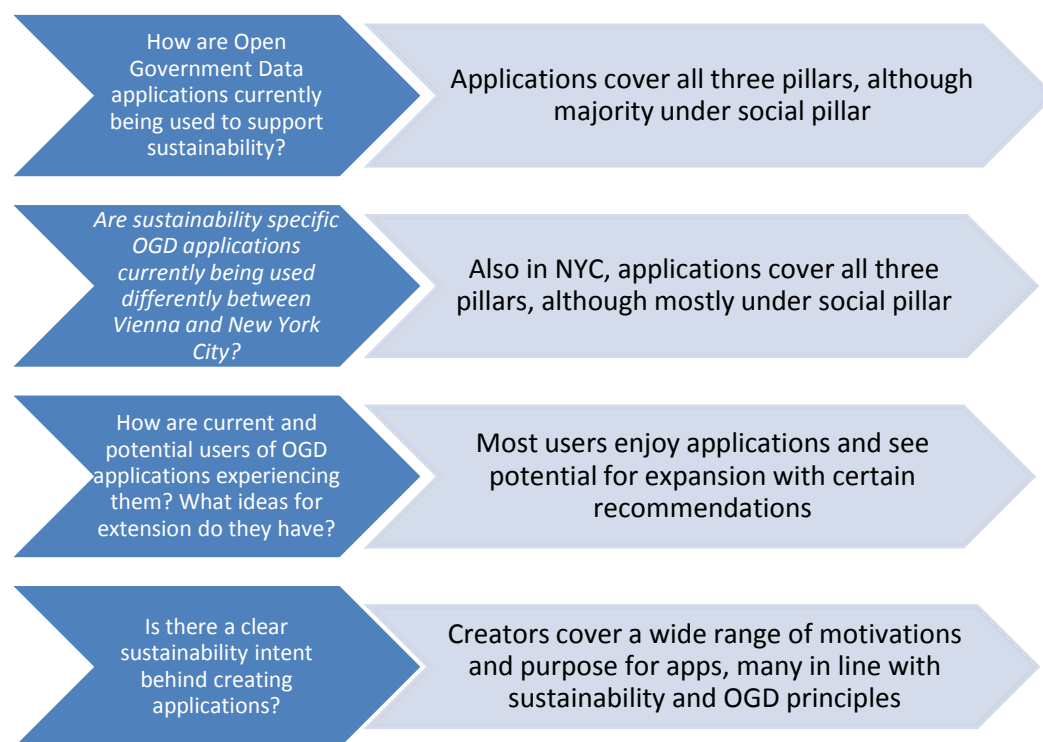


FIGURE 11: OVERVIEW OF MAJOR CONCLUSIONS

How are Open Government Data applications currently being used to support sustainability?

Based on the findings of the taxonomy categorization for open government data applications in Vienna, the majority of current applications fall under the social pillar of sustainability. While some applications can also be characterized by the environmental and economic pillars as well, there is still much room for expansion in these categories. There is also room for expansion among the applications which combine any two or all three pillars. It would not be necessary for all applications to contribute to all three pillars simultaneously, but some increased complexity in the uses of the applications might be beneficial for supporting sustainability on the whole.

Are sustainability specific OGD applications currently being used differently between Vienna and New York City?

Simply comparing the taxonomy categorizations between Vienna and New York City, the OGD applications in both cities appear to be very similar. New York City also hosts a large proportion of applications which fall under the social pillar, and much fewer under economic or environmental sustainability. Upon closer inspection however, New York City hosts more applications which bridge multiple pillars and are a bit more complex in their purpose and usage.

How are current and potential users of Open Government Data applications experiencing them? What ideas for extension do they have?

Generally, all participants in the focus groups in both Vienna and New York City enjoyed testing the OGD applications in the respective cities and see potential for such applications to be used in the future. As technology continues to progress and citizens increasingly rely on their mobile devices for a myriad of purposes, there is a possibility for increased collaboration and participation with governments to be a part of this as well. Lack of awareness of the applications and initiative in general appears to currently be a barrier to more widespread usage, which could be remedied with any number of awareness campaigns. As the applications continue to progress and expand, participants in this study felt it was important for the applications to have some general characteristics regardless of purpose. The applications should above all function well, they should also be fun and easy to use, they should look appealing, and they should contain reliable, useful data.

Is there a clear sustainability intent behind creating applications?

Creators of applications in Vienna expressed a wide range of motivations for creating their applications as well as a wide range of purposes and domains for the applications themselves. Many creators indicated improvement of city life as a motivation for creating their application from this open government data. This motivation is encouraging especially as the applications continue to evolve and become more complex. Hopefully these creators will work to find ways to make the applications truly useful for a number of purposes including sustainability. Similarly, the majority of creators indicated improvement of city life for citizens and education and empowerment of citizens as the primary goal of their applications. These goals along with the motivations indicate that many creators in Vienna might be agreeable to additional communication and brainstorming across multiple stakeholder groups to expand the initiative in innovative ways.

How can Open Government Data be used and extended to foster efforts for sustainability especially in urban settings?

Based on the findings for each sub-research question, it will be possible for these applications created from open government data to foster efforts for sustainability in urban settings. While the social pillar of sustainability is the most heavily represented by the current catalog of applications in both Vienna and New York City, there are applications which cover all three pil-

lars. Even in small ways, these applications are contributing to efforts for positive sustainable development among users. In order for these applications to evolve and develop to contribute in larger ways towards greater sustainability in urban settings, several general recommendations have been developed. A summary of these recommendations can be found in Table 6.

TABLE 6: SUMMARY OF RECOMMENDATIONS

Recommendation	Primary Stakeholder Responsible
Increased Awareness and Marketing of OGD Initiative and Applications	Government
Applications Must Function Well	Creators
Data Must Be Accurate and Reliable	Government
Strengthened Channels of Communication (ex. Forums for suggesting ideas for future apps)	Government, Creators, Users
Network of Sharing Best Practices over OGD Initiatives Worldwide	Government, Creators, Users

The OGD initiative will only be truly successful with citizen participation in the form of actually using the applications which have been developed. General awareness and marketing of the applications must be increased in order to encourage these levels of participation. Governments releasing the data sets may be able to also promote the initiative among citizens, although third parties could also be contracted for such a task.

For the applications to continue to be used, they must function well. Focus group participants in this study emphasized the need for the applications to be easy to use and not overly complicated. Along with the convenience of applications on mobile devices has also come increased expectations that these applications will work well and very limited patience among users if they do not. Creators must keep this ease of use in mind when creating applications. The applications may be complex in their processes, but should be streamlined for the user experience.

Another vital aspect of the applications will be that the open data being used is accurate and reliable. In order to build trust between all stakeholders, the basic data provided by governments must be trustworthy. This accuracy must continue to be ensured throughout the entire creation of the application, with safeguards put in place to guarantee the data cannot be tampered with during the process.

As the OGD initiative involves multiple stakeholder groups, increased communication between these three main groups, governments, creators, and users, is imperative. All groups will benefit from knowledge and idea sharing, especially as there are unique skills and abilities possessed by each group. Users may have innovative ideas for potential uses for the applications, but may lack the technical ability to create the application themselves. Similarly, governments may see a specific need in the community, or an application to accompany a particular initiative or department, but again are unable to create this alone. Innovation may be increased by the sharing of ideas between all groups.

This increased communication would also benefit stakeholder groups on a larger scale. Creating a network between cities to encourage sharing of difficulties and best practices of their OGD initiatives would be beneficial. This knowledge sharing across locations would hopefully spur on additional innovations as this opens up ideas flowing from a much larger pool of individuals. Especially with regards to sustainability, as applications are created in one location which successfully foster increased sustainable practices, it would be imperative to spread those applications to additional locations. Through the increased spread of these types of applications, the benefits will become exponential as we work towards solutions to this complex global issue of sustainability.

7.2 Assumptions

As the open government data initiative is continuously evolving and taking shape across the globe, this particular thesis was limited to a certain point in time for the study. Even through the process of collecting information to be included in this study, the number of applications in Vienna more than doubled. The number of applications are increasing and will hopefully continue to do so in the future. The scope of purposes and domains these applications cover may also continue to evolve, and previously unimagined uses for these applications will hopefully be created.

The focus groups used in this study were purposely kept to small numbers of participants in order to ensure discussion participation from all members. While this study did not aim to have a representative sample of the entire population in either city, the number of respondents does limit the possibility of generalizing these findings on a larger scale.

7.3 Future Work

While this thesis was limited in scope based on certain time constraints, there is great possibility for additional research on this topic.

- This thesis primarily focused on creators and users of OGD applications, but further study could be done from the point of view of the government as the third major stakeholder.

- If more complex sustainability applications become available or could be designed, they could be tested specifically with users to gain truer insight into their effectiveness and usability.
- As some focus group participants pointed out, these OGD applications have uses beyond individuals. A study could explore how these types of applications could also be used in educational and other settings.

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APPENDICES

Appendix A: Open Government Data Applications - Vienna

Title	URL	Description	Pillar(s) of Sustainability
48er-App	http://www.wien.gv.at/umwelt/ma48/beratung/app.html	Garbage collection utility (explanation of garbage types, map of collection points, schedules etc.)	Environmental, Social
A Story about Vienna	http://www.patrick-wied.at/projects/a-story-about-vienna/	Aims to be a visualization of why Vienna has been rated the most livable city in the world, although not an interactive map, more of just a visual illustration	Social
Abfahrt	http://www.data.gv.at/anwendungen/abfahrt/	Transit information, locate desired connection and get a countdown prior to departure	Environmental, Social
Accessible Vienna	http://ist-lab.sti2.at/accessibleVienna/	Location of barrier free and otherwise handicapped accessible locations (restaurants, cafes, theaters, parking, etc.)	Social
ALLiSearch.com	http://www.alliarch.com/	Search for places of interest and events around Vienna (restaurants, hospitals, car share, city bike, leisure activities, events etc.)	Social
Allryder	http://www.data.gv.at/anwendungen/allryder/	Compare routes based on time and cost across multiple transport mediums, including real time information and navigation	Economic
Ambulanzen in Wien	http://data.wien.gv.at/apps/ambulanzen-wien.html	Interactive map of all outpatient clinics in Vienna with basic contact information and route planning as well as emergency numbers and hospitals	Social
AppFahrt	http://data.wien.gv.at/apps/appfahrt-windows.html	Shows all public transportation stops in Vienna, closest to your current location	Environmental, Social
Behinderttenparkplätze	http://www.data.gv.at/anwendungen/behindertenparkplaetze/	Shows location of handicap accessible parking places, and interesting places nearby	Social
Büchereien in Wien	http://www.data.gv.at/anwendungen/buechereien-in-wien/	Shows nearest library	Social
Budgetvisualisierung	http://www.data.gv.at/anwendungen/budgetvisualisierung/	Visualization of budget figures	Economic
Burgen und Schlösser in Wien	http://data.wien.gv.at/apps/burgen-schloesser-wien.html	Interactive map of all castles and palaces in Vienna, including route planning	Social
Bushaltestellen in Wien	http://www.data.gv.at/anwendungen/bushaltestellen-in-wien/	Shows location of nearest bus stop	Environmental, Social

Citybike Wien	http://data.wien.gv.at/apps/citybike-windows.html	Shows all Citybike locations in Vienna	Environmental, Social
crowdranking	http://crowdranking.com/groups/0?lang=de	Social network for group ranking - especially looking at the Vienna segment of this existing platform	Social
Defis in Wien	http://data.wien.gv.at/apps/defi-wien.html	Location of defibrillators in Vienna and allows for emergency phone calls from the app	Social
Der Radfahr- begleiter für Wien	http://www.data.gv.at/anwendungen/der-radfahrbegleiter-fuer-wien/	Assists in planning bicycling routes	Environmental, Social
Eventphant - Events finden	http://data.wien.gv.at/apps/eventphant.html	Shows all events in Vienna	Social
Eversport	http://www.data.gv.at/anwendungen/eversport/	Facilitates people's access to sports and recreational facilities	Environmental, Social
Exponiam - Kunst- stinkubator	http://www.data.gv.at/anwendungen/exponiam-kunstinkubator/	Brings together artists and buyers, identify artistic talent of tomorrow and promote the art location in Vienna	Social
Familiengesundheit	http://www.data.gv.at/anwendungen/familiengesundheit/	Helps with planning of family medical care, calendar for upcoming appointments, checklists, diary	Social
Farschulen Wien	http://data.wien.gv.at/apps/fahrschulen-windows.html	Location of driving schools in Vienna	Social
Findaloo - öffentliche Toiletten finden	http://data.wien.gv.at/apps/findaloo.html	Location of public toilets in Vienna	Social
Fruchtflye - Obstbäume auf öffentlichem Grund	http://data.wien.gv.at/apps/fruchtflye.html	Locations of publicly accessible fruit trees in Vienna including ripeness information and recipes	Environmental, Social
Fundboxen in Wien	http://www.data.gv.at/anwendungen/fundboxen-in-wien/	Locations of Fundboxes in Vienna	Social
Gackerl Sackerl	http://data.wien.gv.at/apps/gackerl-sackerl.html	Location of dog waste bags	Environmental
goÖffi	http://www.data.gv.at/anwendungen/gooffi/	Departure data for Wiener Linien	Environmental, Social
Helios - Entdecke Kunst in Wien	http://data.wien.gv.at/apps/helios.html	Leads to over 40 points of interest in Vienna through fun "balloon ride"	Social

Hundezonen in Wien	http://www.data.gv.at/anwendungen/hundezonen-in-wien/	Shows the nearest dog zone or waste bag dispenser	Environmental
iDump - Altstoffsammelstellen am Smartphone	http://data.wien.gv.at/apps/idump.html	Shows location of trash and recycling receptacles in Vienna	Environmental, Social
Immo-Focus-Wien	http://data.wien.gv.at/apps/immo-focus.html	Creates a .pdf of the surrounding area with points of interest	Social
Import Baumkataster Wien in Open Street Map	http://www.data.gv.at/anwendungen/import-baumkataster-wien-in-open-street-map/	Tree registry on Open Street Map including tree height, species, etc.	Environmental
InstaPLAY	http://www.data.gv.at/anwendungen/instaplay/	Shows location of nearest play places in Vienna	Environmental, Social
Interaktive Budgetvisualisierung mit Google Motion Charts	http://data.wien.gv.at/apps/budget-harm.html	Interactive budget charts for Vienna	Economic
Inveni Wien	http://www.data.gv.at/anwendungen/inveni-wien/	Personal, dynamic and flexible travel guide for Vienna	Social
IZY Wien	http://data.wien.gv.at/apps/izy-wien.html	Locations of over 25,000 points of interest in Vienna on a map	Social
KakusaMusa	http://data.wien.gv.at/apps/kakusa-musa.html	Shows a selection of new and interesting works of art	Social
KLocator Wien	http://data.wien.gv.at/apps/klocator-windows.html	Finding nearest toilet on a city-map	Social
Kultur:App	http://data.wien.gv.at/apps/kultur-app.html	Entertainment, Theater, Concert locations	Social
Kunst im öffentlichen Raum in Wien	http://data.wien.gv.at/apps/kunst-oeffentlicher-raum.html	Find and identify any monument or commemorative plaque in Vienna	Social
Mach mit!	http://data.wien.gv.at/apps/machmit.html	Contribution to open government initiative: invites citizens to contribute with critiques and ideas to enhance daily life. In first line citizens are invited to report damages in streets and public places to respective communities	Social
MeetArt	http://data.wien.gv.at/apps/meetart.html	Information and background information about all kind of art objects in public space	Social
Museen in Wien	http://www.data.gv.at/anwendungen/museen-in-	Shows locations of museums in Vienna, uses GPS data to show what is closest to you	Social

	wien/		
MyITS - Der intelligente Routenplaner	http://data.wien.gv.at/apps/myits.html	Multidimensional route planning; 4 options: public transport, bicycle, walking, car	Environmental, Social
Natur in Wien	http://data.wien.gv.at/apps/natur-wien.html	Find natural monuments in Vienna	Environmental
Next.Wien. - Wo ist der nächste...?	http://data.wien.gv.at/apps/next.html	Find next.... (pharmacy, park.....anything)	Environmental, Social
ÖAMTC App	http://data.wien.gv.at/apps/oeamtc-app.html	Traffic, parking, and park and ride information	Environmental, Social
Öffentliche WC Wien	http://www.data.gv.at/anwendungen/oeffentliche-wc-wien/	Helps locate the nearest public toilet in Vienna, uses actual GPS data to show the one closest to you	Social
Öffis	http://www.data.gv.at/anwendungen/oeffis/	Wiener Linien data, additional traffic information	Environmental, Social
One2Go	http://www.data.gv.at/anwendungen/one2go/	Calculates current location and distance to bus stop, follows current location until you get there	Environmental, Social
Open Data Wien Plan	http://www.data.gv.at/anwendungen/open-data-wien-plan/	Browser based online map of Vienna using all content of the data catalog	Social
Open Pins Vienna	http://data.wien.gv.at/apps/openpins.html	Open Data Vienna for iPhone, combined with GPS, facebook, twitter and e-mail functions	Social
OpenVienna - Android App	http://data.wien.gv.at/apps/android-app.html	Open Data Vienna for Android	Social
Park Finder Vienna	http://data.wien.gv.at/apps/parkfinder.html	Find a park or green space nearest to your location	Environmental
Platzerl Finder	http://data.wien.gv.at/apps/platzerlfinder.html	Find sports facilities and complexes	Environmental, Social
PlayZone	http://www.data.gv.at/anwendungen/playzone/	Location of play zones and family friendly activities, schedule meetings or spontaneous meetings	Environmental, Social
pocketAustria: reale Städte in virtueller Applikation	http://data.wien.gv.at/apps/pocketaustria.html	Find any kind of public infrastructure	Social

POIbase	http://www.data.gv.at/anwendungen/poibase/	Free software for easy installation of POIs on a navigation system	Social
POIRadar	http://data.wien.gv.at/apps/poiradar.html	Find points of interest	Social
Polizeiinspektionen in Wien	https://itunes.apple.com/at/app/polizeiinspektionen-in-wien/id576761483?mt=8	Location list of Vienna Police stations and city police commands and interactive map with route planning	Social
Pollenradar Wien	https://play.google.com/store/apps/details?id=kiefer.ogd.dingle	Shows the allergy-producing trees and their surroundings in Vienna	Environmental, Social
Radwege Wien	http://www.data.gv.at/anwendungen/radwege-wien/	Shows location of bike routes in Vienna	Environmental, Social
Realnutzungskartierung Wien	http://www.data.gv.at/anwendungen/realnutzungskartierung-wien/	Shows real-use mapping of Vienna	Economic, Social
Schwimmbäder in Wien	http://www.data.gv.at/anwendungen/schwimmbaeder-in-wien/	Shows location of nearest swimming pool	Social
Schwimmpreisrechner	http://bad.sonar1.mobi/	Shows nearest swimming pool in Vienna. The ranking is based on the price of admission.	Economic, Social
Sozialmärkte Wien	http://www.data.gv.at/anwendungen/sozialmaerkte-wien/	Shows location of the next social market in Vienna	Economic, Social
Spielplätze Wien	http://www.data.gv.at/anwendungen/spielplaetze-wien/	Shows location of the next play area in Vienna	Environmental, Social
Spinning Circle - Preise berechnen	http://www.data.gv.at/anwendungen/spinning-circle-preise-berechnen/	Bike messenger service, calculates prices based on distance of delivery	Economic, Environmental
Spitäler Wien - Windows Phone App	http://www.windowsphone.com/de-at/store/app/spit%C3%A4ler-wien/c5a5fc67-10fc-4a8c-af77-db1d3bff838e	Shows the Viennese hospitals in a list or map view based on location	Social
Story Hunter	http://www.data.gv.at/anwendungen/story-hunter/	Helps both residents and tourists find lesser known places of interest in Vienna	Social
Taxi Wien	http://www.data.gv.at/anwendungen/	Shows location of nearest taxi stand	Social

	n/taxi-wien-2/		
Toilet Map Vienna - Augmented Reality App	http://www.open3.at/2011/05/toilet-map-vienna-augmented-reality-app-basierend-auf-open-data-der-stadt-wien	Finding nearest toilet based on the user location	Social
U-Bahn Wien	http://www.data.gv.at/anwendungen/u-bahn-wien/	Shows location of nearest U-Bahn station	Environmental, Social
Up Down Vienna	http://www.data.gv.at/anwendungen/up-down-vienna/	Information on elevator outages and maintenance for those with limited mobility using Wiener Linien	Social
Validating and exploiting Open Government Data with R	http://www.data.gv.at/anwendungen/validating-and-exploiting-open-government-data-with-r/	Tutorial to show how to retrieve OGD and use it with R.	Social
Vienna City Bike	http://www.data.gv.at/anwendungen/vienna-city-bike/	Find the nearest CityBike location for BlackBerry 10	Environmental, Social
Vienna districts in numbers	http://www.bjelic.net/app4at/	Relationship between the districts of the city of Vienna, the population and income over a specified period	Economic, Social
Vienna Events - iPhone App	https://itunes.apple.com/de/app/vienna-events/id442891364?mt=8&ls=1/	Information about events in the city of Vienna and their location	Social
Vienna Finder	http://www.data.gv.at/anwendungen/vienna-finder/	Searches nearest locations depending on actual position	Social
Vienna Location Service	http://www.data.gv.at/anwendungen/vienna-location-service/	Blackberry app, helps to find location of nearest toilet, bicycle, etc., also events	Social
Vienna Real Time	http://www.data.gv.at/anwendungen/vienna-realtime/	Departure data for Wiener Linien	Environmental, Social
Visualisierung Einnahmen - Ausgaben (Finanzgebarung)	http://www.data.gv.at/anwendungen/visualisierung-einnahmen-ausgaben-finanzgebarung/	Visualization of budget figures	Economic
Visualisierungen von Bevölkerungsstatistiken	http://www.data.gv.at/anwendungen/visualisierungen-von-	Visualization of population statistics	Social

	bevolkerungsstatistiken/		
Visualisierungen zur Infrastruktur	http://www.data.gv.at/anwendungen/visualisierungen-zur-infrastruktur/	Visualization of infrastructure	Social
WanderLeo	https://play.google.com/store/apps/details?id=at.apptour.leopoldsberg	The app helps the user along the path Leopoldstadt mountain and shows places that are encountered during the walk.	Environmental
Wanderwege Wien	http://www.data.gv.at/anwendungen/wanderwege-wien/	Highlights 11 city hiking trails, including maps	Environmental
Wann - Deine Abfahrten. Sofort.	http://www.data.gv.at/anwendungen/wann-deine-abfahrten-sofort/	Real-time data of the Wiener Linien	Environmental, Social
Wann aufs Amt?	http://www.data.gv.at/anwendungen/wann-aufs-amt/	Visualization of the waiting times in the municipal offices of Vienna	Social
Wave	http://www.data.gv.at/anwendungen/wave/	Language assistant for Vienna which answers questions in natural language. Main purpose to help people use green transport to reduce emissions and help users find green spaces	Environmental, Social
wegwerfen.at	http://wegwerfen.at/	Information about correct separation of waste, type of waste disposal sites, recycling and the opening times of the collection	Environmental, Social
Wien Guide	http://www.data.gv.at/anwendungen/wien-guide/	Travel and point of interest guide	Social
Wien POIs	https://itunes.apple.com/at/app/wien-pois/id554596171?mt=8	Information about services in the city of Vienna and their location. It offers 39 different categories (a total of nearly 20,000 points of interest), including bathing, camping, schools, kindergartens, hospitals, toilets and many more	Social
Wien Punktgenau	http://ogd.mpitzer.at/#x=1823849.418472&y=6143760.7879735&z=12&all=false&mode=km&active=	Provides a browser-based online map of Vienna in order to find the location of point of interests	Social
WienApp	http://apps.microsoft.com/windows/de-AT/app/wienapp/f8183dbb-0b68-4b36-b2c0-ab48735799ab	Information on public services, which are offered by the City of Vienna. These services include aspects of public transportation, bus stops, bike & City taxi ranks, disabled parking, demographics, population, environment, cultural events and more information and other facilities of public life.	Economic, Environmental, Social
Wiener Baumdichte - Waben	http://www.data.gv.at/anwendungen/wiener-baumdichte-	Visualization of tree density	Environmental

	waben/		
Wiener Geländemodell	http://www.data.gv.at/anwendungen/wiener-gelaendemodell/	Visualization of Vienna terrain models	Environmental
WienMobil	http://www.data.gv.at/anwendungen/wienmobil/	Visualization of over 20,000 points of interest	Social
WienPlan	http://www.wien.rststadtplan.at/	The Open Data Map provides a browser-based online map of Vienna. In addition, it uses all location content of the data catalog of the City of Vienna and the base maps of OGD Vienna	Social
WienTaxi	http://www.windowsphone.com/de-de/store/app/wienuxi/eacf1fa4-ecf7-4f81-8aa7-4f12256bcc62	Shows the taxi stands in Vienna on the map	Social
Willi - Wiener Linien	http://www.data.gv.at/anwendungen/willi-wiener-linien/	Route planner for Wiener Linien	Environmental, Social
Wo steppt der Bär in Wien heute?	http://pythagoras.pickl.eu/baer/baer.html	Information about events in the city of Vienna and their location	Social
Woody	https://play.google.com/store/apps/details?id=at.flamingos.woody	Promotes respect for nature in Vienna. The app creates a playful way for awareness of the Vienna trees. It is educational and very entertaining game for all ages. This project was developed as part of a course of INSO research group at the TU Vienna.	Environmental, Social
zoomsquare	http://www.data.gv.at/anwendungen/zoomsquare/	Real estate searching app, also shows location of nearby schools and shops	Social

Appendix B: Open Government Data Applications – New York City

Title	URL	Description	Pillar(s) of Sustainability
596 Acres	http://596acres.org/	Helps neighbors form connections to the city-owned vacant lots near them through maps, signage and online with the aim of growing food and providing educational programs on the lots	Economic, Environmental, Social
ABC Eats	https://developer.cityofnewyork.us/app/abceats	Restaurant grades and inspection reports	Social
Appetition	https://developer.cityofnewyork.us/app/appetition	Helps create, support and promote location-based petitions (fix pothole, etc.)	Social
AWIPT Art Which Is Public and Temporary	http://franWolanczyk.Tumblr.com	Shows public artwork in NYC	Social
Best Parking	https://developer.cityofnewyork.us/app	Parking search engine to help find the cheapest and most convenient parking garages and lots in 100 cities and 115 airports in North America.	none
CalCutter	https://developer.cityofnewyork.us/app/calculator	Enter your own recipe and number of servings and calculate estimated calories per serving. Will also suggest substitutions to help lower calories	Social
ChildCareDesk	http://2013.nycbigapps.com/project/151/child-care-desk-find-quality-child-care-near-you	Aims to help parents find quality child care centers near them	Social
cultureNOW	https://developer.cityofnewyork.us/app/culturenow	Shows cultural assets of over 70 American cities. Explore public art collections, historical and recent buildings, cultural institutions, etc. includes audio and video as well as podcasts and tours	Social
DemocracyMap NYC	http://app.democracymap.org	Allows you to look up the different governments you belong to and learn about all of your representatives from hyper-local to national level	Social
Don't Eat At	donteat.at	Uses NYC public restaurant inspection dataset to see which restaurants are at risk of being closed	Social
Embark NYC	http://letsembark.com/	Transit information and route planning even without cell or internet signal	Environmental, Social

Gardeneers	http://gardeneers.us	Merges urban gardening with social networking. Helps people find urban/community gardens or create their own. Post tips or updates about their crops, marketplace to buy/trade/sell what you've grown	Environmental, Social
HealthyOut	http://nycbigapps.com/project/228/healthyout-find-a-healthy-meal-whenever-you-are	Helps users find healthy meals at local restaurants	Social
Helping Hands	http://2013.nycbigapps.com/project/178/helping-hands-putting-hope-within-reach	Aims to help people navigate, apply and enroll in social benefits	Social
Hired in NY	http://2013.nycbigapps.com/project/243/hired-in-ny-a-mobile-app-to-manage-the-job-search-process	Makes it easy to discover, connect and apply to thousands of jobs at 2,000 NY-based startups and small companies	Economic
Hopscotch	http://2013.nycbigapps.com/project/303/hopscotch-coding-for-kids	iPad programming language for teaching kids to code. Drag and drop blocks of code into scripts and create their own games and apps	Social
MINY Discount Vendors App	https://developer.cityofnewyork.us/app/miny-discount-vendors-app	Find vendors participating in Made in New York discount program	Economic
NavYor-Konnnect	http://www.navyorkonnnect.com/	Helps people connect with friends to meet up for activities, gives location of nearby places	Social
New York Trip Builder	www.nytripbuilder.com	Creates personalized itinerary including must see places as well as unique recommendations based on personal preferences	Social
NextStop NYC Subway	https://developer.cityofnewyork.us/app	Real time NYC subway information	Environmental, Social
NYC 311	https://developer.cityofnewyork.us/app/nyc-311	Government information and non-emergency services. Help report graffiti, lost items in taxis, potholes, street signs, tree damage, dirty vacant lots, etc.	Social
NYC Buildings	https://developer.cityofnewyork.us/app/nyc-buildings	Mobile app that features many searches available on the website, real time department notifications and contact info	Social
NYC City Hall App	https://developer.cityofnewyork.us/app/nyc-city-hall-app	Latest news from the mayor's office, also connects to the 311 app	Social
NYC Condom Finder	https://developer.cityofnewyork.us/app/nyc-condom-finder	Shows locations of free condom distribution venues	Social

NYC Media	https://developer.cityofnewyork.us/app/nyc-media	Hundreds of hours of video about everything in NYC	Social
NYC Stuff Exchange	https://developer.cityofnewyork.us/app/nyc-stuff-exchange	Locations to donate, buy or sell different types of gently used goods in NYC	Economic, Social
NYC Way	https://developer.cityofnewyork.us/app/nyc-way	Wide range of information and usages, incl. traffic cams, wifi hotspots, open table, subway stations, police stations, 311 requests, volunteer opportunities, location of museums, libraries, cultural centers, etc.	Social
NYCrecycles	https://developer.cityofnewyork.us/app/nycrecycles	Recycling game to test knowledge about what can be recycled in NYC	Environmental, Social
NYPD	https://developer.cityofnewyork.us/app/nypd	Official app of the NYPD, wanted gallery, crime videos, submit a tip, breaking news, precinct boundaries	Social
ParkAlly	www.parkally.com	Aims to set up connections for parking spots based on time and price in order to avoid endless circling for street parking (helping to reduce carbon emissions and decrease congestion)	Economic, Environmental
Poncho	http://2013.nycbigapps.com/project/251/poncho-a-simpler-weather-service-with-a-personality	Simple, personalized daily weather forecast and transit delay/parking information	Environmental, Social
Roadify	https://developer.cityofnewyork.us/app/roadify	Real time transit information	Environmental, Social
Sage: Pre-K and Elementary Schools Search	http://nysage.com/	Pre-k and elementary school search, see basic information, state exam results and NYC progress report grades	Social
Scene Near Me	www.scenenearme.com	Alerts you when you are near NYC film scenes	Social
SolarList	http://2013.nycbigapps.com/project/164/solarlist-an-app-that-empowers-and-pays-students-and-young-entrepreneurs-to-educate-homeowners-about-their-options-for-going-solar-by-providing-free-home-solar-assessments	Instant, mobile solar assessment tool to calculate a homeowner's costs and savings for a range of financial options. Train students and young entrepreneurs to educate homeowners about solar options, get paid by network of installers.	Economic, Environmental, Social

Stable Renters	http://stablerenters.com	Rates landlords and management companies by combining property records, housing violations, open 311 complaints, lawsuits, and user comments	Social
Streetnet	http://streetnet.st/nyc	Brings every address, street and neighborhood in NYC online with its own domain name, message board and link to directions and geographic information	Social
Teens in NYC Protection	https://developer.cityofnewyork.us/app/teens-nyc-protection	Shows location of clinics that provide sexual health services for teens. Allows for anonymous searching	Social
TestFlip.com Personal Safety App (Lite) for NYC	http://acft.ws/bevg	Personal emergency app to alert the nearest police precinct or phone number by sms or pre-scripted voice message or custom email	Social
The Funday Genie - by YooGuide	http://www.thefundaygenie.com/thefundaygenie.aspx	Assists in planning a free day - using a scheduling and route algorithm to create a personal itinerary of things to do	Social
Trees Near You	www.treesnearyou.com	Display of tree registry data	Environmental
Uhpartment	www.uhpartment.com	Provides building maintenance reports for apartment hunters	Social
Urbien	http://urbien.com/	Combines elements of virtual and real world to help create connections, help between neighbors, micro-entrepreneurship etc.	Economic, Social
Wateron-theGoNYC	https://developer.cityofnewyork.us/app/waterontheGONYC	Location of water fountains open during the summer	Environmental, Social
wattQuiz	http://wattquiz.com	Quiz that educates about energy usage, correct answers generate watts that are donated to charities via donorschoose.org	Economic, Environmental, Social
WayFinder NYC	https://play.google.com/store/apps/details?id=com.deadlyandroid.ar.nycs subway&hl=en	Uses augmented reality to show nearest NYC subway and PATH stations. Provides map of current position and walking directions	Environmental, Social
Weeels	www.weeels.org/weeels-app.html	Allows users order taxis and share rides with other nearby users	Environmental, Social
Work+	https://developer.cityofnewyork.us/app/work	Helps people find places to work outside of their homes, search by specific criteria (wifi, coffee, quiet, etc.)	Social
You the Man	https://developer.cityofnewyork.us/app/you-man	Helps find a ride home, car service, nearest subway station, help calculate blood alcohol content, etc.	Social

Appendix C: Focus Group Discussion Questions

Individual Experience During the Testing Period:

Which apps did you download? Why?

Which mobile applications did you view? Why?

What was the purpose of your apps?

What were your hopes for their usage?

How would you characterize their ease of use?

How often did you use them? Do you think you were within the normal range of what the creator intended for usage?

Did you find any complications or confusion which made you less likely to use the app?

Would you continue to use this app in the future? Why or Why not?

General thoughts about OGD apps:

In general did you enjoy using apps such as these?

Were you aware of their existence prior to this testing phase?

Would you be interested in checking back with the applications in the future to see which new ones develop?

What types of applications or activities would you hope to be found in these applications in the future?

What do you think should be some of the main purposes of these types of applications?

Based on what you have seen, does the current catalog encompass these?

Where do you see opportunities for expansion in the future?

Do you think these types of applications could lead to increased citizen involvement in city governance?

Would you be more likely to participate in government if it were accessible on your mobile device?

Sustainability through OGD apps:

Thinking about all three pillars of sustainability, economic, environmental and social...

What contributions could you see applications like these making to both individual and group sustainability?

What type of general characteristics might be most helpful in making these apps useful and attractive to a wide audience?

If apps like these were made available, would you personally use them?

Appendix D: Focus Group 1 Notes

Starts with round of who downloaded which apps

N1: I looked for an app to help me get to know Vienna better...story hunter

J1: I also used story hunter...(shares an example) Stephansplatz...piece of wood...didn't know what it was, was able to look it up on the app...would be more useful with more information

N1: I liked the pop-up reminders that followed you around and let you know where you were near

J1: It uses a lot of battery life though

M: I downloaded easy parking Vienna – didn't work...shut down after 30 seconds or so on the tablet...had some trouble with apps

K: Yes, I also had some trouble getting apps to work...Schwimmbad...frozen...map didn't work...language was also a bit of a challenge...some more apps in English would be helpful. Also tried Radweg app which didn't work

J1: I also tried to download Radweg but couldn't find it in apple store...apple store is currently set to Croatia so some of these apps didn't appear.

K: Things designed for ease of use and tourists seem somewhat difficult to use

N1: Some for tourists require access to data and wifi to use maps, which tourists may not have access to

J1: I downloaded toilet locator app...also Vienna LS...which shows lots of points of interest and locations, and she will continue to use it for toilets

The group agrees these toilet location apps, silly as they might be, are very useful

M: Vienna guide app really nice...shows picture and description of where things are, links to website for additional information

J1: Eventphant...events in Vienna...almost too many events to keep up with, but very useful and something she will continue to use

K: Mistplatz...couldn't find information in English, but very helpful for residents of Vienna, also interested in where recycling depots are

J1: Vienna LS includes some of this waste disposal information

K: It would be helpful to know where to dump large items or toxic things, because people don't generally know where to take these things

What were you looking for when looking through the apps?

N1: Ones available in English...what is interesting to me personally

K: Apple icon...English

J1: English...toilet apps...things to help me get to know the city a bit more

M: Ones interesting to me...had some trouble with the web applications working on various browsers...tried the visualization of the demographic data...and didn't work in internet explorer only in google chrome...stopped using the ones which didn't work

K: I am easily frustrated, so I might not have messed around with multiple browsers to get them to work. Noticed authors listed next to some applications...are people proud of them? Want to be associated with them?

N1: you can still make a bit of money off these apps

In general, did you enjoy using the apps?

N1: good introduction to what's out there, no way of knowing these existed otherwise, will download a bit more in the future, including back home

M: didn't know these were available in app form, thought it was only available online, probably won't use it again

K: a bit of a rush when it does work, sense of reward to finding these cool, convenient things...but the opposite can also be true, easily frustrated

Were you aware of these types of apps before?

K: not at all, possibilities are fascinating, and the idea of using it for municipal government is really interesting. App in German explaining local government would be really interesting if she could understand it. Recent local election she would be allowed to vote in, but didn't have full knowledge of the election details and all sides of the argument, so such apps could be helpful

J1: would love to see these types of apps in Croatia as well

K: information seems to be out there, but not in an accessible way, so these apps might be helpful for collecting and organizing this information

J1: I would not go online and look up all this data, but in an app form I would use this

Would you be interested in checking back in with the apps? As they expand in the future

J1: if I stay in Vienna, yes.

N1: in another city, yes

M: no, I wouldn't check again

K: I would, and also thinking about how she could use them in teaching practice, kids like things packaged in this form, could these also help with education

N1: I would be very specific about which types of apps I would download in the future, probably mostly tourist related, even in a city she is quite familiar with.

M: is the information reviewed by the government? Is it all correct? I wouldn't trust such applications or information in Lebanon as I would assume it is incorrect.

K: young people might be able to organize themselves and provide their own information, which in some places might be more correct than governments

Discussion of fruit trees in Vienna app...who knew these types of data were being collected?

N1: shows the differences between problems facing different regions...if we have nothing to worry about other than fruit trees...

If you were going back and looking for more apps? Would you be looking for something in particular? Or just browsing?

K: expansion of Schwimmbad app...a recreational sport program app would be helpful...for organized teams and for public fields

N1: can't think of anything specific...and wouldn't necessarily think of an app to solve her problems

Is this a generational thing? Will we grow into this?

K: probably...we've moved from PC to tablet to phone

M: having to update these apps constantly makes them less useful in some cases

N1: it would be interesting to see how the different types of phones (apple, android) experience these apps

J1: I would use it more for general education or tourist knowledge and curiosity rather than solving problems. If I was going to another country traveling I would not download an app for only a few days or a week. But if I was in Vienna and had tourists coming I would download it for them.

Are we just in a weird timeframe? No dog, no car, etc? but not tourists?

N1: if you've lived here long enough you might not need this information anyway

-Short break-

J1: listing all the contents of the Vienna LS app

M: are there places of worship included?

Is that a public data set? (churches)

N1: what about that banana on the outside of buildings? Is there an app for that?

K: a multi-denominational app for places of worship would be useful

Do you see opportunities for these to expand? Or will they continue to just be a tourist/toilet thing? But not our ticket to individual public participation?

N1: perhaps not our ticket but yes for future generations

M: if they were more user friendly, without constant need for internet, yes

N1: if more people knew about them, then yes

K: apps have a future with future generations, feels like a game, apps give the instant gratification of knowing things immediately, what did people do before? Ask people for directions? Buy a map?

J1: I still try to ask people for directions

Would you be more involved in your city as a result of apps/platforms like these?

M: how often is the information updated? Number of tourists? People living here?

N1: how often would that change online anyway? It would depend on the survey years

J1: for museums and things that wouldn't matter

M: how reliable is the information, how up to date is it

N1: the last census cycle would be the most updated you could have anyway

M: karlsplatz used to have the number of tourists constantly

J1: there are trackers in town to count how many bicycles pass

K: there is one at prater that counts bicycles

N1: who owns this data? Is that OGD?

It could...if the counter were linked to the OGD portal...

Thinking of 3 pillars of sustainability...what contributions could you see these applications making

N1: social for sure...events applications...if there was an app for public meeting information...allows for communication between multiple stakeholders

J1: Education for sure

K: yes, with geography and population...environmental for sure...bike trails...toxic waste dump information...town meetings. A case to be made for economic as well, more transparency as to what the government is doing and individuals more likely to invest

Do you see these mostly at a collective level? Or also individual? Would you be willing to report your activities to contribute to the aggregate?

N1: depends what it is and where I am

K: aren't many of your activities tracked anyway?

J1: they know when you're paying to park, etc

N1: I don't know that it is boosting economic activities

J1: tourism can change economy

N1: would the app increase the number of tourists who would come?

J1: for some people yes

K: Vienna is getting a reputation for being an easy city for tourists, public transportation, free activities, this could help encourage that mindset

J1: companies are probably developing apps who could also invest in the city and the tourist experience

K: Fernwärme is genius...garbage to energy...publicize that more so people know more about it...share information about how these projects are functioning

N1: Vienna seems to be somewhat of an anomaly, such a green city

K: systemically yes, but not on an individual level necessarily

What types of general characteristics make these apps useful?

J1: availability across multiple platforms, some with and without internet

M: offline maps for tourists

N1: making people aware of the apps in general

J1: better PR and marketing, if you didn't tell me about this I wouldn't know

K: partnership with hotel industry highlighting helpful apps

N1: is there an app for wine and vineyards?

M: Italy has a guide available in Italian and English outlining wine

N1: Vienna tourism would increase if the wine culture was better publicized

Any final thoughts?

M: would be nice to have an app for trains and buses to places outside Vienna for tourists...to Salzburg, Baden etc. nearby places of interest...skiing

K: emergency services...even at this point I would be unsure who to call

J1: we could build a translator app in the phone to help with emergency service calls

K: hospital websites aren't very helpful...an app for walk in clinics would be helpful or where to go in case of not needing the emergency room but medical attention.

M: app available to help people who have been out drinking get home, will come drive you home and take your car home too

K: something to show where to buy food on Sundays would be helpful...also Christmas/easter markets etc.

J1: it's good, but still has more development

K: needs to be accurate, reliable and easy...people need to learn to trust them

N1: transparent

K: I will tell people about these now! Have you heard of the fund boxes? If you lose something people put it in these boxes and there is an online catalog of all lost things for you to search.

M: there is a similar app for lost dogs

That about covers everything...

Thanks to everyone!

Appendix E: Focus Group 2 Notes

What apps did you look at/download?

J2: Story hunter, Open Pins, Vienna LS

O: what are those about?

J2: Story hunter about interesting places in Vienna...push notifications when you're near one...tells you about it. Open pins...plan of the city with interesting places highlighted (toilets, dog zones)

O: Next stop Wien...trams, subways timetables. Park Finder...a bit useless...I would look for a park by walking rather than on this app. Taxi 31300...was useful to help find a taxi or have a taxi sent to you

P: Vienna Events and Easy Parking...Easy parking didn't work, but I used the free version and there is also a paid version as well

When you were looking for apps, what was your hope for them?

O: Next stop Wien, I was looking for a transit app. This is the first one I've used

P: Is this the same as Qando?

J2: Qando is perfect, why would we need another one

Are we just creating unnecessary repetition or is there room for duplicates?

J2: No I don't think so, different people and different personalities can make/use different things or different interfaces...otherwise it would be like saying different operating systems were useless just because they do similar things. For example Open Pins and Vienna LS are basically the same with regard to the data they contain. Initially the Vienna government site had a stadt plan online with the same data, but it was slow and not user friendly, so now this same data is contained in these applications which is much better and easier to use.

Were the apps fairly easy to use?

All: yes

Why did you choose these particular apps?

O: I was looking for transit apps, taxi and trams, and I was looking for places to run which is why I downloaded the park finder, but didn't find it to be as helpful as just running to find parks. The taxi app might be helpful if you're at home, but generally if you're out in town you're close enough to a taxi stand.

P: or if you're at a friend's house who doesn't live near a taxi stand

Would you continue to use these apps in the future?

O: next stop Wien for sure

J2: Story hunter, very helpful to know these things about Vienna, something I always wanted to know about Vienna.

O: You can also google it

J2: With google you just get facts and not stories, it is useful and interesting. Might be better if it was somehow more open and users could add their own stories or correct data through a review process, might help add other places which are not the most popular.

Do you find that it drains your battery to keep it open all the time?

J2: I'm using other location service apps, so I don't notice a major difference having added this one.

O: Does it also speak to you? Or do you have to read it?

J2: Just reading, but listening would be a good idea, turn your phone into an audio guide. There are now some guides inside the app which require you to pay to access them.

P: I don't know with the parking app when they update their data, it tells you how many spaces are available on the street, but not if they are full. Useful for disabled people because it does indicate accessible spaces.

J2: The city plan is good because there are some facilities which would never be put in google, like public toilets, are on here. I often feel the need to find them when I'm out on the street.

P: but then I go in the next café or something

J2: also public drinking fountains. If you're a tourist you wouldn't have to pay for bottles of water if you had a map for these.

Were you aware of the existence of these apps before this project?

P: taxi app yes, but not the others

J2: I was aware of the stadt plans online, because I read about them, but was useless

O: I was vaguely aware of them, but hadn't used them

Would you go back and look for others knowing these are being added to daily?

J2: yes

P: probably, yes.

J2: having come to Vienna a year and a half ago there are different ways to experience the city and this is one of them. When I moved here I was able to find a list of fresh markets on the stadt plan and there was one close to my house which I was otherwise unaware of because it was on a small side street. But now I am able to go there to buy fresh produce. Or the parks, I like to change the parks I run in, or run through multiple so I could save time using this app.

P: but major parks you would already know, are you just circling in these small parks?

J2: I would rather run through multiple small parks than on the streets, so I think there might be other people like me who enjoy this

What types of apps are you looking for? What activities?

P: they need to be more promoted in the app store

Did any of you have issue finding these apps in the app store? Some people were having issues with different countries app stores?

J2: maybe, although I switched my app store to Austria

What else would you look for? What beyond location services?

O: restaurants would be helpful, is there one for that?

Since they are coming from OGD I'm not sure what of restaurants they keep track of, although they do keep track of some interesting things.

P: locations and information for public buildings would be helpful, where to go when you need various things

J2: the Vienna LS shows the public buildings

P: is it also showing where you need to go for various things? What each building contains?

J2: I'm not sure it goes into that detail

If the purpose is to improve transparency, collaboration and, public participation, do the current applications encompass this?

P: some of them do

J2: If they are made by individual users, it is successful in engaging both creators and users

Is there a disconnect then between what the government might want and what the individuals create?

J2: If they recognize a need as being crucial and not already created, they should engage a third party to fix it. For example if a magistrat office is getting constant phone calls about something which could be explained on an app, it would make sense for them to be sure this information is accessible to the public in this form. A creator might not know about this need because they aren't the ones hearing the phones.

-a brief discussion as to where the raw datasets themselves live online and how creators access them-

Where do you see room or a need to expand the reach of these apps in the future? If our aim is citizen engagement?

J2: I think my suggestion with Story Hunter could also be useful applied to other apps. Citizens might notice problems with infrastructure, potholes etc, before the official checks. So having this two-way feedback between users and government could help with the participation

There seem to be apps for tourists and apps for residents to some extent, with regard to trash and parking and government services versus museums

P: but even as a resident how often would you need information regarding trash? Would you download an app for this rather than just look on the website these few times you need this information?

J2: some of the apps, like open pins, have these things included in the large list of datasets, so you could just look at it the one time you need it

P: perhaps if it was included I might, but I wouldn't see this as necessary for an app

Would you be more likely to download one of these all-encompassing apps versus the more specialized ones?

P: yes, because otherwise you would end up with 100 different apps

J2: the nature of the individual data needs to be taken into account, how complex they are, for example, things like trash places might only require location services, so they could be included with others, but if there was a more sophisticated app about where to go for all sorts of government services, that might be better off as an individual app.

Do you think these types of things would make you feel more connected to your city? Is it more personal being on your phone than on a website?

P: for me it's the same

O: I like the apps being so accessible wherever I am

P: but everything is also available online

Thinking about the 3 pillars of sustainability, is there room for this tool to help with sustainability in cities? Or is it just the social aspect?

J2: I see all 3 pillars, if an app enables you to do sport activities, it's social part...

O: it seems to be heavily socially weighted, although taxi apps could foster economic competition, more free market

J2: Vienna events could help with economic development as well

P: but there seems to be almost too many events on here

J2: as far as environmental...

O: with all of these you're using battery

J2: but some of the environment ones, like public fruit trees could limit the need for imported fruits

P: also the trash places

J2: the city bike app serves all 3 at the same time

Also the budget data being available...

P: I would look up this information potentially

J2: If it was interesting to look through

P: but the apps in general need to be more heavily promoted, nobody knows about these

J2: especially in pre-election time the budget information might be useful to see, to make better decisions based on this information

Other than marketing, what other general characteristics should these apps have?

P: they should work

J2: although bugs and updates seem to be a normal part of these apps, but they should be careful not to get a reputation for them not working

O: also to be compatible with all types of cell phones

P: should be completely free, not have to pay for the full versions, otherwise I'd be tempted to just look at the website

J2: if third parties are making them, what incentive do they have?

P: aren't there contests for creating these? Perhaps as part of Vienna 2020?

J2: an investment could be made in the prize money for these competitions to attract more creators

Does this draw the right type of people then?

J2: the financial model could be that they are paid for parts of the service, or the government could give a small prize for the winner and then pay over the next year to help them keep it updated

P: perhaps even tax reductions, especially here

Any other characteristics?

J2: Vienna being such an international city, availability in English might be important, especially for tourists

If you're a tourist in a city would you download an app only for the days you're there? Even if you don't have internet service?

P: yes perhaps a city guide

O: you can find wifi or a starbucks or something

J2: this app shows wifi hotspots

O: but you need wifi to get to it

P: I'm not sure I would download an app for the trip, more likely just google it

J2: Offline maps would be helpful, it's not as helpful as google maps, but you can download some and save them to your phone to use while you're out in the city. It might be possible with the open pins type of app to create these maps and save them.

Any other closing thoughts? Do you think there's a future with these?

J2: yes, definitely

P: if there is enough promotion and people know about them

O: we do more and more on our phones, so I think there is definitely a future with these apps. Although some of these apps could make people lose their jobs, like museum guides, there are two sides to this.

J2: demand for these jobs may decrease but that's part of progress

P: internet will probably be more accessible in the future, so the issue of offline maps might not be a problem, even tourists would have access

Thank you!

Appendix F: Focus Group 3 Notes

Which apps did you download/look at?

E: Eventphant, the other apps didn't seem to fit me since I don't always have internet on my phone, so this allowed me to scroll through and look things up, didn't require location services

A: I found most of the apps kind of useless, looked at the Wanderweg one, but realized that information was all contained on an app or I knew them. But one of the apps I use constantly is already on the list, Willi app for transit. I use that daily, the real time information is really helpful.

N3: I use the Wann app multiple times per day for transit information. I also downloaded Vienna Events, which wasn't as useful. If I want to go somewhere I can look up the individual events online rather than in this app.

S: I used Wien LS which is a good overview of everything in Vienna, and Park Finder, but that seemed useless because I could look at a map, also Eventphant. Many of the apps were not relevant or interesting to me.

What about some of the apps made them uninteresting or irrelevant?

S: I didn't want to spam my phone with lots of apps, 2 of them which I downloaded for this trial I will delete after today

E: My main problem was that I don't have internet on my phone, I rely on wifi, so multiple apps would have slowed down my phone. If there were offline versions I might have put them on my phone, but perhaps even still I wouldn't.

Did the apps you downloaded work?

S: I had some trouble finding the apps in the German app store, many didn't seem to be available.

N3: The two I downloaded worked fine

Would you continue to use these in the future?

All: Yes

A: I wouldn't download any others, but will continue to use Willi

Did you enjoy using the apps? Is this interface in your pocket different than websites or paper?

N3: it's comfortable

S: I find that since I do have internet in my pocket I open the apps and scroll through them while I have to wait somewhere

E: That's how I used the Eventphant, I didn't go to any of the events, but I enjoyed scrolling through and seeing what was going on. It was interesting to see all the festivals and events happening.

Were you aware of the apps before I asked you?

All: No

A: Except Willi, but I didn't know it was part of this initiative

As this project continues to grow, would you look back and see what additional apps are added and if any of those fit into your life?

E: Definitely, I was interested to see what data is out there and what is possible. OGD seems to be essential for a good, healthy society. For citizens to know that this data is available. I looked at what was available in my home country as well, even though I can't use them, but just to see what is available there. Seems like a good resource for creative people with the skills to make apps.

A: I think they are interesting but I think a lot of them are unnecessary. I think people will download them but not really use them.

E: I think I know what you mean, it seems that many are created by an individual for an individual, so they may be unnecessarily personal. But it is sort of cool that you could make something personal like this to solve a personal problem.

Are there certain types of activities you would look for to be covered by these apps?

A: There were two apps that I saw that were cool but not relevant for me, the Pollenfinder and another one about forests which was in German so I didn't download it. The language is a barrier.

E: I thought about what I would like in my home country, a crime rate map would be helpful to know which places are more or less dangerous to walk through or live in. This wouldn't be necessary for Vienna, but for large metropolitan places it could be.

S: Many apps seem to be duplicates of each other, so if I downloaded one app which only does a certain task, I might find one which works better or covers more and replace it.

Do you think there should be some way of regulating the amount of duplicate apps? Or just let them be created as they come?

S: It's personal what you prefer and what you don't, but there are about 10 apps just for parking

E: Limiting who can create them seems to go against the whole initiative in the first place

A: some of them are restricted by which operating system they work for

What do you see as the main purposes of these apps?

N3: Help with everyday life, make citizens lives easier, nothing too serious.

S: Time management and effectiveness, although sometimes I just use common sense and don't need an app for it. I don't need an app for everything, I don't need to spend time getting used to an app.

A: the basic thing is to get more comfortable with the city, for example the city bike app, you could learn these things as a newcomer and then not need the app forever.

We might also be on the front end of app users, do you see this as continuing to expand?

S: definitely

E: I think it will continue

A: If in the past year it has nearly doubled, just imagine the future. People want to be entrepreneurs so they will continue to expand these things, although repetition will also increase as it becomes easier to make these.

E: I think the knowledge of how to make these apps personal will increase, using the raw data available to make your own personal apps rather than using apps for public use.

Would you be more willing to participate in your city in different ways because of these apps?

S: Definitely, the access makes it easier, you can check out things which are close to use

N3: Sometimes you cannot find things on websites this easily, so you can try out these apps

S: there are no risks involved, especially if you don't have to pay

A: I'm not sure about there not being risks, if you're using the app you might be creating your own trail of data as well.

Is that a barrier? Or as we increase two-way data sharing will we see the benefits outweighing the risks?

S: It is part of the service it offers, them knowing my habits is the exchange for the personalized service I am enjoying.

E: The volume is also increasing, so as everyone is being monitored it is like nobody is being monitored. I don't feel like anyone is looking at my data personally. It doesn't feel personally invasive.

S: It also depends on the type of data being shared, I still don't feel comfortable with online banking or purchases, but I don't mind if people know I went to a museum or restaurant.

A: We don't consciously recognize where the data is coming from when they are using these apps, you become less aware over time because it becomes more normal.

Thinking of all 3 pillars of sustainability, do we see these apps as being useful across all 3 pillars, or mostly just social?

S: Depends on the app. With parking you might save time not circling around looking for a spot, helping with environment.

A: The increased awareness of what all is around you could help

E: Having so much information available the possibilities are endless, opening it up to everyone gives a better chance of the right creative person finding ways to uniquely use the information to make apps which will help in all these ways.

There might be a disconnect now between who knows how to create an app and who has the ideas for what to use, if we could figure out how to connect these people, could this be a tool to help shape people's habits?

E: Most certainly. The possibilities are exponentially increased by it being so open, allowing anyone to try.

A: Also how interactive it is helps to make it more attractive to a wide audience. If it is colorful and fun to use, or simulate a challenge of some kind, it could increase the popularity.

What sort of general characteristics would you say are required for these apps being attractive to the widest possible audience?

N3: Easy structure, easy to find what you want, simple.

S: Combine different features in one app. I would prefer one app to be more complex than having multiple apps which I don't have more permanent use for.

E: With the complexity though, also having a way to remove sections which you don't need. Making the apps more customizable would be useful.

A: The game-like quality would be attractive as well, but they need to still have actual usefulness.

Any closing thoughts? Ideas?

S: I don't know how the government site is organized, but how do they select their apps?

I don't exactly know the vetting process for the Austrian site, but at the rate they are expanding I don't know that there is much control.

S: I think the government should control for duplicates to ensure quality

E: I think they should remain unrestricted as long as the apps are searchable and I don't have to scroll through a huge list of app names. If there is too much it might become overwhelming and you wouldn't want to pick any.

A: Maybe on the website they should give people a forum for requesting apps. This would help connect the users to creators in a more concrete way. Some sort of open bulletin board might help to further the creative process rather than continuing to create duplicates or very similar apps.

E: As someone who is not a regular app user, it is cool knowing these are out there and available. Just their existence improves my feelings of Vienna being a city which is forward looking and has this open mindset. As these expand and new things are created could help convert me into an app user potentially.

Thank you!

Appendix G: Focus Group 4 Notes

Which apps did you download and why?

K: I downloaded NYC Way, ABC Eats, Protection Teen NYC, and NYC Water.

NYC WAY - seemed like from the description was a comprehensive NYC app, and had the most "buzz" about it (featured in mags and endorsed by Bloomberg or something like that). Purpose seems to be a "one stop" NYC app. My hope for it was that it would be something I could refer to so that things would all be in one place. However, I did not like this app. It had way too many categories and was not easy to use. It also looked very cheap and wasn't that fun. I actually do have several separate apps in the categories they covered, and will continue using those, not NYC way. I did not use this often at all, much beyond exploring it. Seemed like it was intended to replace many apps that people use regularly, but I did not find it to be well created. Categories were a little confusing and since there were so many of them, it was overwhelming. Will delete this app.

ABC Eats - Was curious about health code violations since I kind of keep up with that. Purpose is to provide users with updated information about health inspections in NYC neighborhoods. Includes not only ratings, but also what violation each restaurant received that led to that score. Super interesting and gross. I'm pretty conscious about the ratings when I eat at a restaurant, but will occasionally eat at a restaurant with a B - and would use this to see what the violations were for if a restaurant was rated a B. It's sorted by neighborhood, and then alphabetically after that. Once you click on a restaurant, it lists all the inspections in the last couple years with the scores, so you can see if there was an improvement or decline in cleanliness. It was easy to use. I have not used this one much yet, but will keep it, as I think that I would use it as I visit different places. I didn't come across any complications or confusion.

Protection Teen NYC - since I often refer teens for sexual health services, wanted to try this out to see if it would be a good resource for them. Purpose is to provide teens with where to go for services, information on birth control and STD prevention, and information about what to expect when you visit a clinic. I really liked this app a lot, and will keep it for use with my clients. I used to have to go online, print out resources and give it to teens I work with, but providing this app for them is great. It's seems really teen friendly and easy to use. I like that there's options to save "favorites" and that it links to videos on Facebook about "what to expect." The lists of services/clinics might be a little overwhelming for younger teens, but I would plan to use it in conjunction with education in therapy - so they could ask me questions they have that they come across. Haven't referred teens to it yet, but it's been a short time. I will definitely keep this app, and hope that I find it useful in my work.

NYC Water - downloaded because I thought it might be useful to have for when I go running or when I'm out with the dog. Purpose described was to provide user with up to date info on nearby water fountains/sources. Does not work. There is not even outdated info on it, just blank screens. Will delete.

E: I chose Next Stop app and ABC eats...Next Stop transit app, subway specifically. Highly accurate, normally within a couple seconds...map shows actual location of next train, even had connectivity within train stations (which normally may not be the case) even at busy stations would show all possible trains and countdown to next train. Only time it was inaccurate was only about a minute off. Helped to make decisions regarding which train to take when there were multiple options. Already had the app when asked to participate in this project. ABC eats, New York Department of Health, gave health ratings for restaurants. App wasn't as developed, not all restaurants included and display not as shiny and smooth as other apps. I would definitely keep using the Next Stop app, I would see if the ABC eats app improves over time before deciding to continue to use it.

T: I downloaded NYC Way, and eventually signed up for Poncho. I chose NYC Way because it had a variety of features and thought it would be the most versatile. Poncho came highly recommended and since I look at the weather forecast every day, it eliminated a step of going to another weather app since it is sent directly to my text messages.

T: NYC Way was meant to be a resource for a variety of different aspects of NYC life – from where to find food, entertainment, museums, etc., to wifi spots and traffic cameras. Poncho is simply giving a weather forecast with supplemental information that helps people understand how the weather will change throughout the day so they can be better prepared.

T: NYC Way was really easy to use, although when I first got the app there were so many different topics to choose from, many of which were blank place holders, it got took some time navigating and setting up the app so I could get the information I was interested in. For example, transportation information was on the fifth scroll-through page, so I made a section for my favorites and put that in there but then had to go back in and arrange the favorites section so it stayed near the beginning of the page for ease of use. The transportation section was the most complete and that is what I used it the most for – especially since once I opened a map, the app saved it so I could use it underground without an internet connection. Poncho was just lovely, didn't take too much information to get started, sends me texts messages with the weather at times that I dictate so it is really handy.

T: Poncho gets used every day. That's the way I believe it is meant to be used. NYC Way got used maybe 2 times per week, although I used it more when I was outside of my regular routine – going to conferences, running errands, etc. I imagine the creators expected it to be used more but I am a creature of habit so once I have a routine I'm not going to take my time to look up something different. But, I do think it is meant to be used as a resource for city information and I definitely used it as such.

T: Except for my slight complaint about the format and blank spots of NYC Way, I thought they were both pretty easy to use and understand once I spent a bit of time with them. Nothing so complicated that I wouldn't keep using the apps. Both of these I will continue using in the future in some capacity. Also, I customized Poncho to tell me if alternate side parking is suspended so that is super helpful.

In general did you enjoy using the apps?

K: Generally, I think the concepts are good, execution was poor on many. I think I will enjoy using the two apps above that I decided to keep.

T: I do enjoy using apps like these when they actually have the information I am looking for – it's all information I would seek out anyway, just makes it more accessible.

E: I did, I really like using the Next Stop app because it was super convenient, especially in NYC when transportation can sometimes be complex. I don't think I took the ABC eats app as seriously.

Were you aware of these apps prior to the testing period?

K: I was aware of apps like this due to NYC ads on subways and other areas. Wasn't aware of the ones I downloaded, but did know that apps like these existed.

E: No, not specifically. I didn't know they kept records of all these things

T: I would say I was aware of some of the OGD info, however I never knew that it was called OGD. It had crossed my mind previously to wonder where in the world the people who made these apps had acquired the information. This testing also raised my awareness of the scope of information that is out there.

Knowing these applications are being added to, would you check back to see which new ones develop?

T: Oh yes, I would definitely check back in to see new developments and updates.

K: I would be interested in checking back to see what new ones they come up with.

E: I would. Especially after since I'm in the process of moving to a new city. For my new city I would hope for information about restaurants, bike lane navigation and transit times, museum guides, points of interest, information regarding boats and canals, coffee shops, local specialties. Also accurate weather would be helpful, or more detailed.

What would you say are some of the main purposes of these applications?

K: I think main purposes should be to create meaningful connections with city, be helpful for residents, provide easy to access information that would be difficult to get otherwise.

T: The purposes seem to be centralizing information – things that people already have access to but may have to go through a lot of steps to find – weather, restaurants, transportation, etc. A lot of these apps include social activities – sort of like a Time Out NY for your phone. The current catalog encompasses these items – some of them do it well, others need some work.

E: Make life more convenient or easier for residents.

Do you think the current catalog of applications encompasses this?

K: Current catalog is not very comprehensive, but it seems like many are making an effort to do this.

E: Yes.

Where do you see opportunities for additional expansion of apps in the future?

T: I'd like to see more information on the sourcing of food – sort of like the seafood watch

apps – but for meats and dairy products. I know that information is out there somewhere because it is regulated. I'm more into things about food than where night clubs are located.

Do you think these applications could lead to increased citizen involvement in governance?

K: Not currently. I don't see a clear connection there.

T: I have no idea if these types of applications could lead to increased citizen involvement. As they stand currently, only to a certain point. Word of mouth is powerful and most of the information wouldn't be exciting enough create a buzz. As more information is made accessible, maybe if it was done very well there could be a growth in some areas where certain groups feel government is hiding things from them and the application gives them access where they felt left out before. If there were apps that shared info on permits given out by the city, city council meeting minutes, etc and made that information really accessible I could see people who are prone to activism using that as a tool to get more people involved in causes.

E: Perhaps, because it could help ease city life and increase transparency which may be seen as good or bad.

Would you be more likely to participate in government if it were accessible on your phone?

K: I would definitely be more likely to participate in government if I could do so through my phone. Much of the reason I don't is because I think it's too time consuming.

E: Apps directly sponsored by city departments where that is visible might help people feel more connected to these individual departments and help create relationships between government and the actual citizens

T: I don't know if I would be more likely to participate in government – outside of voting and taxes I don't feel all that connected and I can't think of how an app on my phone would impact my involvement level.

Thinking about the 3 pillars of sustainability...what contributions could you see apps like these making?

E: I think they're more geared toward social, although this social aspect could trigger increased involvement in the other two pillars

T: This is difficult to predict in general terms. I could see groups getting more involved in an environmental issue if an application impacted individual users both socially and economically causing them to change their lifestyle while supporting them socially.

What type of general characteristics might be most helpful in making these apps useful to a wide audience?

E: They should look nice, if they are slow or look old people will not believe in the accuracy. Should be convenient and accurate and load quickly.

T: Apps have to have good design, be up-to-date, not take up too much space on your phone, be both practical & informative, and create some sort of a buzz about them – marketing and word of mouth are powerful!

If apps like these were made available, would you personally use them?

T: I'd use them if the purpose fit what I was interested in.

E: Yes, I would definitely use ones that work well and are well reviewed by others.

Appendix H: Survey for OGD Application Creators

Name of your application:

1. When creating this application you were working as a/an:
 - ☐ Individual/group of individuals
 - ☐ Employee at an organization (non-profit)
 - ☐ Employee at a for-profit company
 - ☐ Government Employee
 - ☐ Other (please specify)
2. The main motivations for creating this application were (Please select all that apply):
 - ☐ Direct financial gain (from sale of app only)
 - ☐ Indirect financial gain
 - ☐ Hobby
 - ☐ Exploring new technologies
 - ☐ Facilitating improvement of city life
 - ☐ Gaining personal recognition
 - ☐ Participation in app development competitions
 - ☐ Creation of a start-up
 - ☐ Part of job responsibility
 - ☐ Academic responsibility
 - ☐ Other (please specify)
3. What is the primary goal of your application?
 - ☐ Advertisement of a service
 - ☐ Government transparency and accountability
 - ☐ Improvement of city life for citizens
 - ☐ Improvement of government services
 - ☐ Education and empowerment of citizens
 - ☐ Nature care and conservation (environmental sustainability)
 - ☐ Other (please specify)
4. The domain(s) that best describe your application are:
 - ☐ Culture/Entertainment
 - ☐ Transportation
 - ☐ Health
 - ☐ Demographic
 - ☐ Education
 - ☐ Nature and Recreation
 - ☐ Location/Points of Interest
 - ☐ Accessibility

- Sanitation
- Civil Service
- Tourism
- Other (please specify)

5. Number of downloads of the application to date (if known):