

# OPEN DATA

A TWENTY-FIRST-CENTURY ASSET  
FOR SMALL  
AND MEDIUM-SIZED ENTERPRISES



APRIL 2015

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**STEFAN VERHULST  
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<sup>2</sup> This report was based on data gathered and analyzed through November 2014.

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# Executive Summary

Although we live in a data age, much information has until recently been privately held and access to it has been restricted. This is starting to change, however, with the rise of the open and shared data movement. Increasingly, it is clear that we are entering a new era of access, innovation, and transparency.

Today, it is widely held that open and shared data has the power to fuel economic growth, job creation, and new business opportunities. The consulting firm McKinsey predicted the possible global value of open data to be over \$3 trillion annually.<sup>4</sup> A study commissioned by the Omidyar Network concluded that open data could increase the output of G20 countries by some \$13 trillion over five years.<sup>5</sup> But for all the excitement about the potential of open data, very little is known about how it actually works—the precise variables, parameters, and pathways through which it translates into growth and opportunities.

The purpose of this paper is to better understand how open and shared data impacts the economy. Focusing on small and medium-sized enterprises (SMEs) and start-ups, we consider 354 case studies of companies currently using open data, so that we can better understand how open data can be used and how it can contribute to economic growth, new jobs, greater innovation, and other improvements in our social and economic lives. Grounding our analysis in empirical studies allows us to identify the most important issues confronting any SME considering an open data strategy. It provides lessons and principles that have proven, real-world applicability.

Our analysis is structured around ten key questions. These questions encompass both the potential and challenges of open data. Among other issues, we consider:

- ▶ Different sources and types of open data and how these differences affect the economic potential of open data;
- ▶ The relationship between open data in its “pure” form and other forms of open and shared data that often come with certain restrictions, but that nonetheless have the potential to foster economic growth and innovation;
- ▶ Market segments, data products, and different models of value creation currently being explored by open data SMEs;
- ▶ The importance (and difficulty) of establishing metrics to capture the impact of open data; and
- ▶ Some of the risks involved in using open data.

From our discussion of these (and other) issues, we have arrived at ten principles for the effective use of open data. We examine these principles in the conclusion. They should be considered preliminary and, given the rapidly evolving nature of the field, subject to change. Nonetheless, put together, they provide a road map or guide for SMEs considering an open data strategy.

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4 James Manyika, Michael Chui, Diana Farrell, Steve Van Kuiken, Peter Groves, and Elizabeth Almasi Doshi, “Open Data: Unlocking Innovation and Performance with Liquid Innovation,” McKinsey Global Institute, November 1213, [http://www.mckinsey.com/insights/business\\_technology/open\\_data\\_unlocking\\_innovation\\_and\\_performance\\_with\\_liquid\\_information](http://www.mckinsey.com/insights/business_technology/open_data_unlocking_innovation_and_performance_with_liquid_information).

5 Nicholas Gruen, John Houghton, and Richard Tooth, “Open for Business: How Open Data Can Help Achieve the G20 Growth Target,” Omidyar Network, June 2014, [http://www.omidyar.com/sites/default/files/file\\_archive/insights/ON%20Report\\_061114\\_FNL.pdf](http://www.omidyar.com/sites/default/files/file_archive/insights/ON%20Report_061114_FNL.pdf).

## Key Findings

- ▶ Open data is publicly available data that can be universally and readily accessed, used, and redistributed free of charge. It is released in ways that protect private, personal, or proprietary information, and it is structured for usability and computability.
- ▶ Open data exists on a spectrum of openness. Not all data that is released to the public can be considered “pure” open data. In considering the benefits of open data, we should also consider the growing category of shared data, which can be reused and is frequently made public, but often with certain restrictions. Shared corporate data—in which companies release privately held information to other individuals or entities—is a particularly important phenomenon.
- ▶ SMEs often lack access to data or sophisticated analytical tools to process and analyze large proprietary data sets. They are likely to be among the chief beneficiaries of open data, which requires fewer resources to utilize.
- ▶ Government data, science data, and shared corporate data are the three main categories of open and shared data being used by SMEs. Though government data is by far the most widely used, science data (especially clinical, research, and health-related data) and shared corporate data (e.g., in the form of academic research partnerships, trusted intermediaries, and application program interfaces [APIs]) hold significant potential for SMEs.
- ▶ Open and shared data is used most in the sectors of data and technology, finance and investment, business and legal services, and health care. Despite heavier regulatory barriers in finance and health care, the use of open and shared data is still growing rapidly in these sectors. Technical, organizational, or economic barriers are likely to present more significant challenges to the adoption of open data.
- ▶ Open and shared data is being used primarily to serve the Business-to-Business markets, followed by the Business-to-Consumer markets (and, to a lesser extent, the Business-to-Government market). Though SMEs using open and shared data typically target a single segment, a growing number of the businesses studied here serve two or three market segments simultaneously.
- ▶ In order to yield meaning and insight, raw data needs to be *processed* by SMEs and other organizations. The key steps involved in processing raw open data are cleaning and standardizing; consolidating and organizing; augmenting through linkages and aggregation; and analyzing data through descriptive, prescriptive, and predictive analytics.
- ▶ Open and shared data is being used to create a variety of new business offerings. These include platforms that help analysis, insight, and decision making (by both businesses and consumers); data-driven products such as insurance and loans; data interfaces and visualizations that help increase access to information; consulting services; new software, web, and mobile applications; and services and educational platforms for code and data literacy. Broadly, these offerings can be divided into new data-driven products and services on the one hand, and enhancements of existing processes and products on the other. The new business products using open data can be further separated into the categories of (1) data-driven products; (2) data-driven platforms; and (3) data intermediaries.

- ▶ While open and shared data is usually a free resource, SMEs are monetizing their open-data-driven service in order to build viable businesses. Popular revenue models include subscription-based services, advertising, fees for products and services, freemium models, licensing fees, lead generation, and philanthropic grants. SMEs must choose a revenue model based on their product, their market segment, and the revenue models used by existing and potential competitors within their sector.
- ▶ Developing metrics to measure the impact of open and shared data is a challenge. Efforts to develop such metrics should consider the direct economic value of open data to SMEs; the indirect value of open data to third-party organizations doing business with open data SMEs; the indirect value of open data to consumers using open data SMEs or third-party organizations using open data SMEs; the indirect value associated with open data SMEs on the wider economy (e.g., through increased consumer spending or B2B expenditure); and the wider societal impacts that can be attributed to open data SMEs. Metrics can capture both economic and non-economic variables, and can be either quantitative or qualitative in nature.
- ▶ SMEs face significant challenges in their efforts to collect, store, and use open and shared data. These challenges include difficulties in accessing open data, problems concerning data quality and consistency, insufficient financial and human resources, and issues surrounding privacy (particularly when open data sets contain personally identifiable information).

# Introduction

We live in an information age, but until recently it was nearly impossible to access much of that information. In America and around the world, the vast majority of data has long been tightly controlled by governments, corporations, and other entities.

Only within the last couple of years, with the rise of the open data movement and a growing trend toward releasing data for public consumption, have we begun witnessing the first signs of change. It is now estimated that over one million government data sets are available online globally.<sup>6</sup> Increasingly, it is apparent that we are entering an era of open and shared data, in which freer, less restricted flows of information have the potential to fuel innovation and economic growth. *The Economist* magazine has called open data “a new goldmine.”<sup>7</sup> The consulting firm McKinsey has predicted the possible global value of open data to be over \$3 trillion annually, with \$1.1 trillion attributed to the United States alone.<sup>8</sup> Likewise, a study commissioned by the Omidyar Network concluded that open data could increase the output of G20 countries by some \$13 trillion over five years (equivalent to a growth rate of 1.1 percent, more than half the G20’s collective growth target).<sup>9</sup>

Yet for all the enthusiasm that exists about open data, we know surprisingly little about how it really works, and how its adoption and use can translate into economic benefits. While the impact of so-called big data (marked by the deluge of information produced through the Internet, social media, mobile devices, and other networked technologies) has been substantially researched, and while several studies have been conducted to assess the economic value of open data,<sup>10</sup> we are still in the early stages of understanding how open data can be used to generate revenues, jobs, and other forms of economic value. In particular, we know very little about how open data can be used by companies to grow their businesses and create new opportunities. As one technology blogger recently put it: “By now, ‘open data for the social sector,’ ‘open data for the public sector,’ or ‘open data for hackers’ all roll quasi-easily off the tongue. The concept of ‘open data business models,’ on the other hand, still has many experts in the field scratching their heads.”<sup>11</sup>

The primary goal of this report is to begin addressing this research shortcoming. In what follows, we examine ten key dimensions of open data, considering how it can be collected, stored, and deployed so as to maximize economic value for businesses and other organizations. The ten questions we seek to answer include:

1. What is open data, and how is it related to shared data?
2. Why focus on small and medium-sized enterprises (SMEs)?
3. What types of open and shared data are being used by SMEs and start-ups?
4. What sectors are using open data the most?
5. In what market segments is open data being used?

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6 Jose Alonso, “Announcing the Global Open Data Initiative,” World Wide Web Foundation, June 11, 2013.

7 “Making Official Data Public Could Spur Lots of Innovation,” *The Economist*, May 18, 2013.

8 James Manyika, Michael Chui, Diana Farrell, Steve Van Kuiken, Peter Groves, and Elizabeth Almasi Doshi, “Open Data: Unlocking Innovation and Performance with Liquid Innovation,” McKinsey Global Institute, November 1213.

9 Nicholas Gruen, John Houghton, and Richard Tooth, “Open for Business: How Open Data Can Help Achieve the G20 Growth Target,” Omidyar Network, June 2014, [http://www.omidyar.com/sites/default/files/file\\_archive/insights/ON%20Report\\_061114\\_FNL.pdf](http://www.omidyar.com/sites/default/files/file_archive/insights/ON%20Report_061114_FNL.pdf).

10 See, for instance, Alex Howard, “Open Data Economy: Eight Business Models for Open Data and Insight from Deloitte UK,” O’Reilly Radar, January 28, 2013. “How to Make a Business Case for Open Data,” Open Data Institute. Enrico Ferro, “Emerging Business Models in PSI Reuse,” Enrico Ferro, April 18, 2012.

11 TechSoup Global, “4 Steps Toward Open Data Business Models,” MarketsForGood, October 15, 2013, <http://www.marketsforgood.org/4-steps-toward-open-data-business-models/>.

6. What are four important steps that SMEs can take to add value to open and shared data?
7. What types of products are being created out of open data?
8. How are SMEs monetizing their products and services?
9. How can we evaluate the impact of open and shared data on SMEs and the wider economy?
10. What challenges do SMEs need to overcome to leverage open data for value creation?

While our research has broad applicability, we focus (for reasons we explain further below) on businesses that can be classified as small and medium-sized enterprises (SMEs) and start-ups.<sup>12</sup> Based on our research, we arrive at ten principles for the optimal use of open data for SMEs. Taken together, these principles function as a toolkit or framework for companies considering an open data strategy.

A note on methodology: the research we present here is based not merely on theory or conceptual analysis, but on in-depth examinations of real-world case studies (eight of these case studies can be found in Appendix III). The questions we ask and the answers we provide are drawn in particular from information contained in the Open Data 500 project at the GovLab in New York University. This database includes information and details for some 354 SMEs currently using open data in new and innovative ways. Building our analysis from this database allows us to offer principles based on solid empirical evidence. Our goal is to offer tested, real-world strategies for open data that can enhance opportunities for SMEs to create jobs, increase economic value, and maximize public good.

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<sup>12</sup> Throughout this paper, we use the term SME as shorthand for both SMEs and start-ups.

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# | Foundations

In order to better understand how SMEs can optimize their use of open data, it is useful to first consider some basic principles. These principles serve as foundations for our subsequent discussion: they provide definitions, map the conceptual landscape of open data, and help set boundaries for some of the key terms and ideas included in this report.

# 1. What Is Open Data and How Is It Related to Shared Data?

Like many technical terms, open data is a contested concept, subject to varying interpretations and understandings. There exists no single, universally accepted definition. However, in order to arrive at a working definition, GovLab has recently analyzed nine widely used definitions (Appendix I) and placed them within a matrix for comparative analysis (Appendix I). The resulting definition, reproduced below, guides our discussion throughout this report:

*Open data is publicly available data that can be universally and readily accessed, used, and redistributed free of charge. Open data is released in ways that protect private, personal, or proprietary information. It is structured for usability and computability.*

It is important to recognize that few forms of data actually possess all the attributes listed in this working definition. In fact, the openness of data exists on a continuum, and many forms of data that are not strictly “open” in the sense defined above are nonetheless shareable and usable by third parties in ways that can enhance economic value. For these reasons, our discussion in this report encompasses not just what we might think of as “pure” open data, but also a notion of *shared* data, and more particularly *shared corporate data*.

We use the term *shared corporate data* to refer to a growing trend in which companies have been sharing their privately held information with other individuals or entities. This shared data is often not open in the strict sense of the definition outlined above: it may be shared with restrictions (e.g., on redistribution), and it may come with a nominal cost. Nonetheless, shared data is similar to open data in that it is removed from behind proprietary pay walls, and is accessible to third parties that may process or analyze it in ways that often yield public value.<sup>13</sup>

# 2. Why Focus on Small and Medium-Sized Enterprises (SMEs)?

Small and medium enterprises have been called “the backbone of the U.S. economy.”<sup>14</sup> They are estimated to account for over 60 percent of new jobs created in the United States,<sup>15</sup> and 60–70 percent of new jobs created across all OECD countries. A recent Kauffman Foundation report found that, between 1977 and 2005, start-ups added on average 3 million

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<sup>13</sup> Stefaan Verhulst, “Mapping the Next Frontier of Open Data: Corporate Data Sharing,” UN Global Pulse, September 17, 2014, <http://www.unglobalpulse.org/map-ping-corporate-data-sharing>.

<sup>14</sup> “Small Business,” Office of the United States Trade Representative, <http://www.ustr.gov/trade-topics/small-business>, accessed August 24, 2014.

<sup>15</sup> “Small Business Facts,” SBE Council, <http://www.sbecouncil.org/about-us/facts-and-data/>, accessed August 24, 2014.

jobs in their first year of existence (while existing firms destroyed on average 1 million jobs combined per year).<sup>16</sup> Understanding how open data can be used by SMEs to create economic value is therefore essential to understanding how open data can benefit the economy at large.

There are two more reasons why we focus on SMEs in our discussion of open data. First, SMEs and start-ups stand to be among the chief beneficiaries of open data. Unlike larger companies, SMEs often lack access to data or to the sophisticated (and expensive) analytical tools necessary to process and analyze large data sets. This represents something of a competitive disadvantage. But the rise of an open data ecosystem, which includes not only greater access to information but also a proliferation of tools (often cloud-based) to make sense of information, opens new avenues and represents new business opportunities for smaller businesses. Open data is in short a great equalizer; its positive effects are most likely to be felt by new and smaller businesses.

Second, we focus on smaller enterprises because they are likely to be the main drivers of innovation when it comes to open data. Many established companies tend to view open data as a threat—a disruption of existing business models and legacy revenue models. Existing players are thus more likely to indulge in data protectionism and data hugging, activities that inhibit the spread of open data. SMEs and start-ups, on the other hand, are more likely to see open data as an opportunity. Much of the experimentation and agility required to maximize the potential of open data are thus likely to occur in smaller, up-and-coming enterprises that are better positioned to reinvent business models and the way information is collected, stored, and accessed.

### 3. What Types of Open and Shared Data Are Being Used by SMEs and Start-Ups?

Open data now exists in a wide variety of fields and domains. However, based on our research, we have found that three sectors in particular are responsible for producing the bulk of available data used by SMEs. While many of our conclusions are applicable across sectors, we focus on the use of government data, science data, and corporate data.

#### GOVERNMENT DATA

From the UK to Nigeria to the United States, a growing number of governments around the world have been releasing data sets for public consumption. It is estimated that around 46 countries today have open data policies.<sup>17</sup> The United States (along with some European countries, particularly the UK) has been at the forefront of this revolution. Today, some 38 states and 46 cities and counties in the United States have open data policies.<sup>18</sup> The United States' main open data site, data.gov, currently contains over 157,948 searchable databases.<sup>19</sup>

Today, open government data is one of the main sources of information for SMEs and start-ups. New and innovative businesses have been built around various different types of government data—geographic information, demographic

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<sup>16</sup> "The Importance of Startups in Job Creation and Job Destruction," Kauffman Foundation Research Series, September 9, 2010-, <http://www.kauffman.org/what-we-do/research/firm-formation-and-growth-series/the-importance-of-startups-in-job-creation-and-job-destruction>.

<sup>17</sup> "Open Government," Data.Gov, <https://www.data.gov/open-gov/>, accessed September 2, 2014.

<sup>18</sup> "Open Government," Data.Gov, <https://www.data.gov/open-gov/>, accessed September 2, 2014.

<sup>19</sup> "The Home of the U.S. Government's Open Data," Data.Gov, <https://www.data.gov/>, accessed September 2, 2014.

information, transport-related information, legal information, and much more. Several examples of companies using open government data can be found in Appendix III. Among the four we have studied are:

- ▶ OnDeck, an alternative lending company, uses government data to provide short-term loans to small and medium-sized businesses. OnDeck relies on open government data from a number of different sources, including the Department of Commerce, the Department of Labor, and the Small Business Administration. Founded in 2006, the company has grown rapidly to approximately 240 full-time employees, and in 2013 made \$475 million in loans to small businesses.
- ▶ FindTheBest uses open data from various government sources, including the Department of Defense, the Department of Health and Human Services, the Department of Agriculture, and the Federal Emergency Management Agency. This data is combined with data from company websites and other proprietary sources to help consumers compare products and services and make more informed decisions. These decisions are supported by a data-driven comparative “comparison engine,” which organizes information and presents it along with analysis and visualizations.
- ▶ Credit Sesame, a credit reporting and tracking service, helps users manage their credit, loans, and debt using open government data from the Department of Commerce and the US Census Bureau. This free service allows users to access their credit ratings and provides consumers with tools and information to enable them to refinance their debt and other financial assets and liabilities.<sup>20</sup>
- ▶ Mapbox, an open source platform for designing and publishing maps, uses government data from the Department of the Interior, the US Geological Survey, the Department of Agriculture, the Department of Commerce, and the US Census Bureau to power some of the most popular map-based applications in the world.<sup>21</sup> Based in Washington, DC, this open source application is used by brands such as Foursquare, Evernote, GitHub, National Geographic, Pinterest, and the *Financial Times*.<sup>22</sup> It is one of the largest providers of online custom maps, while also providing web developers and other IT professionals with online software to create their own map solutions.<sup>23</sup>

## SCIENCE DATA

Although less widespread than government data, publicly released science data is emerging as a new growth opportunity for SMEs. Science data can encompass various different kinds of data, including clinical, research, and health-related information. The term is generally applied, however, to research-related information that is made available for third-party use. Such information has been made public (or open) for some time now; the trend dates at least as far back as the 1950s, when efforts were made to advance science by sharing data among scientists and researchers. But the trickle of shared scientific data has become a torrent recently, an acceleration aided by the far greater ease and lower cost of sharing during an era of technical innovation. The Human Genome Project has also played a major role in this acceleration, leading to what one expert has called “a cultural shift to sharing data.”<sup>24</sup> Today, scientific data sharing is increasingly common, facilitated by platforms such as the Open Science Data Cloud, the Open Science Grid, and a variety of other initiatives.

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<sup>20</sup> CreditSesame, <http://www.creditsesame.com>, accessed November 12, 2014.

<sup>21</sup> Stefaan Verhulst, “Business Models That Take Advantage of Open Data Opportunities,” [TheGovLab.org](http://TheGovLab.org), July 23, 2014.

<sup>22</sup> MapBox, <https://www.mapbox.com/>, accessed November 12, 2014.

<sup>23</sup> “Plans,” Mapbox, <https://www.mapbox.com/plans/>, accessed November 12, 2013.

<sup>24</sup> Kerry Young, “Medical Data Use Broadened by Human Genome,” September 8 2014, [http://www.rollcall.com/news/medical\\_data\\_use\\_broadened\\_by\\_human\\_genome-236070-1.html](http://www.rollcall.com/news/medical_data_use_broadened_by_human_genome-236070-1.html), accessed October 15, 2014.

Many donors and funders of research have also pushed grant recipients in the direction of data sharing. The National Heart, Lung, and Blood Institute, for example, requires all recipients of grants above \$500,000 to submit a data-sharing plan.<sup>25</sup> Similarly, in 2012 the European Commission made a commitment to opening access to data from publicly funded science in the belief that “with limited exceptions such as privacy and third party rights—maximizing reusability is the best way to maximize scientific innovation and return on investment.”<sup>26</sup> Advocates of such transparency point, among other factors, to the selective release of clinical trial data by pharmaceutical companies; they argue that this “missing clinical research data”<sup>27</sup> could help better analyze drug efficacy and potential side effects.<sup>28</sup>

A number of companies have been built on the sharing of science data. These include Genospace, a cloud-based software-as-a-service (SaaS) computing platform that securely stores and provides genomic and health data. The company uses data from The Human Genome Project, as well as pooled science data from other research organizations, including the Multiple Myeloma Research Foundation, to increase access to genomic and clinical data, and provide tools for the analysis, visualization, and advancement of genomic medicine.

Compendia Bioscience, a subsidiary of Life Technologies, also aims to be a provider of genomic data. The company began as a way to commercialize Oncomine, a cancer genomics database developed at the University of Michigan that had been used by pharmaceutical companies to develop new cancer drugs.<sup>29</sup> This company has now been transformed into a series of products to help academic and nonprofit cancer researchers, as well as small and major biotech companies, advance their cancer research.

## CORPORATE DATA

Historically, companies have been among the least likely to share data, acting instead to restrict access out of a concern to protect perceived strategic interests or existing revenue streams. However, as the open data movement has spread, a number of corporations have begun to perceive value in releasing data. Corporate data is thus emerging as a new and rapidly growing category of open data.

As noted above (Question 1, on “shared data”), corporate data is often released in a more controlled or limited way than other types of open data. Hence it is perhaps better categorized as shared rather than open data. For example, instead of releasing data for general public consumption, companies may release it through prizes and challenges. Likewise, corporate data may be shared through data cooperatives involving other companies (sometimes even including competitors).

The table below identifies six main ways in which corporate data is currently being shared, as well as some examples of companies currently sharing their data.

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25 “NHLBI Policy for Data Sharing from Clinical Trials and Epidemiological Studies,” National Heart, Lung, and Blood Institute, <http://www.nhlbi.nih.gov/research/funding/human-subjects/data-sharing.htm>, accessed November 12, 2014.

26 Jonathan Gray, “Science, Data and the Public,” *The Guardian*, July 20, 2012, <http://www.theguardian.com/news/datablog/2012/jul/20/data-science-public-open-knowledge>.

27 Harlan M. Krumholz, “Open Science and Data Sharing in Clinical Research: Basing Informed Decisions on the Totality of the Evidence,” *Circulation: Cardiovascular Quality and Outcomes*, <http://circoutcomes.ahajournals.org/content/5/2/141.long>, accessed October 15, 2014.

28 Some have argued, for instance, that several fatal side effects of drugs released to the market could have been identified earlier had all clinical data been released by the concerned pharmaceutical companies and made available to the wider scientific community. See Harlan M. Krumholz, “Open Science and Data Sharing in Clinical Research,” *Circulation Cardiovascular Quality and Outcomes* 5 (2012): 141–142, <http://circoutcomes.ahajournals.org/content/5/2/141.long>.

29 Sarah Schmid, “Ann Arbor’s Compendia Bioscience Acquired by Life Technologies,” *Xconomy*, October 9, 2012, <http://www.xconomy.com/detroit/2012/10/09/ann-ar-bors-compedia-bioscience-acquired-by-life-technologies/>.

## Six Main Forms of Shared Corporate Data

**Academic research partnerships**, formed by releasing data sets to students, research organizations, and universities. In 2014, Imgur, Reddit, FARK, StackExchange, and Twitch created the Digital Ecologies Research Partnership (DERP), a joint initiative to promote “open, publicly accessible, and ethical academic inquiry into the vibrant social dynamics of the web.”<sup>30</sup> Likewise, Yelp, a ratings and review site, provides an academic data set to students and researchers that contains information on businesses located in the vicinity of 30 different universities. Twitter also recently partnered with MIT, providing \$10 million in grant funding, and access to Twitter’s database, to study patterns of public discourse online.<sup>31</sup>

**Prizes and challenges**, in which companies make data available to applicants who compete to develop new apps or innovative uses for the data. In addition to its academic data set, Yelp also conducts an annual data set challenge, providing awards of up to \$5,000 to researchers who use their data in insightful and unique ways.<sup>32</sup> Similarly, LinkedIn, a business-oriented social networking service, recently announced the LinkedIn Economic Graph Challenge, a \$25,000 research award to encourage researchers, academics, and data-driven thinkers to propose methods for using LinkedIn data to solve “some of the most challenging economic problems of our times.”<sup>33</sup>

**Trusted intermediaries**, wherein companies share data with a limited number of known partners. One example is IRI, a market and shopping information site/company, which shares information among its various clients to help them analyze and measure markets.<sup>34</sup> Businesses that use IRI services therefore benefit from the network effects of each others’ research and information.

**Application Programming Interfaces (APIs)** that enable developers and others to access data for testing, product development, and data analytics. APIs are commonly used by technology companies to integrate services across related industries. For instance, Uber, a ridesharing service, recently opened up its API to companies such as Hyatt, United Airlines, and Smart Calendar. Facebook’s popular Graph API is similarly used by thousands of companies and developers to get data in and out of Facebook’s vast social network.<sup>35</sup>

**Intelligence products**, wherein companies share data that provides insights into market conditions. For example, Google provides query-based data through Google Flu Trends, a data interface that estimates current levels of influenza activity in conjunction with data provided by other health surveillance systems, such as the Centers for Disease Control and Prevention.<sup>36</sup>

**Data cooperatives**, otherwise referred to as data pooling, in which corporations band together to create collaborative databases with shared resources. In this model, data is not shared with the public at large but

30 Digital Ecologies Research Partnership, <http://derp.institute/>, accessed September 2, 2014.

31 Joshua Brustein, “Twitter Gives MIT \$10 Million to Study the Social Impact of Tech,” *BloombergBusinessWeek*, October 1, 2014, <http://www.businessweek.com/articles/2014-10-01/twitter-gives-mit-10-million-to-study-the-social-impact-of-tech>, accessed November 12, 2014.

32 “Yelp Dataset Challenge,” Yelp, [http://www.yelp.ca/dataset\\_challenge](http://www.yelp.ca/dataset_challenge), accessed October 19, 2014.

33 Deepak Agarwal, “Big thinkers. Big Data. Big Opportunity: Announcing The LinkedIn Economic Graph Challenge,” *LinkedIn Official Blog*, October 14, 2014, <http://blog.linkedin.com/2014/10/14/big-thinkers-big-data-big-opportunity-announcing-the-linkedin-economic-graph-challenge/>, accessed October 19, 2014.

34 “About,” IRIWorldwide.

35 “Calling the Graph API,” Facebook Developers, <https://developers.facebook.com/docs/ios/graph>, accessed November 12, 2014.

36 “Flu Trends,” Google.org, <http://www.google.org/flutrends/us/#US>, accessed November 12, 2014.

with a specific group (narrowly or broadly defined) of third-party users. This has been a popular strategy used by businesses for decades. For instance, the first Profit Impact of Marketing Strategy (PIMS) database was developed in the 1970s as a way to share data between strategic business units from over 200 companies.<sup>37</sup> More recently, Telecom Italia pooled its data with partners from various Italian industries (local news, automobile, energy, and weather) into a single data set, which was then released as part of an outward-facing Big Data Challenge.<sup>38</sup>

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37 "Overview," *The Strategic Planning Institute: Applying Knowledge to Business*, [http://pimsonline.com/about\\_pims\\_db.htm](http://pimsonline.com/about_pims_db.htm), accessed September 15, 2014.

38 "BigDataChallenge," *Telecom Italia*, <http://www.telecomitalia.com/tit/en/bigdatachallenge.html>, accessed September 15, 2014.



II

# Open Data and Value Creation



SMEs and start-ups considering using open data have several important strategic decisions to make. The stakes of these decisions are high, but it is often difficult to determine the right course of action in what remains a nascent and relatively undeveloped field, with few clear principles for effective use of open data. In this section, we consider some of the most important strategic questions SMEs must ask themselves—pertaining to market segments and sectors, product decisions, and revenue models—and attempt to map the contours of the current open data landscape. Our goal is to provide a manual or field guide of sorts for SMEs considering integrating open data into their core businesses.

## 4. What Sectors Are Using Open Data the Most?

A number of studies have mapped open data use by industry type, trying to identify those sectors in which open data offers the most opportunity. A recent McKinsey Global Institute study, for example, concluded that in the United States, open data offers the most growth potential in health care (which the study estimated at a \$300–450 billion opportunity) and finance (\$210–280 billion).<sup>39</sup> A study conducted by the consulting firm Deloitte in the United Kingdom concluded that the private sector areas that stood to benefit the most were information and communications, finance and insurance, real estate, and health care.<sup>40</sup>

For the purposes of this report, we analyzed the 354 SMEs and start-ups contained in the Open Data 500 to better understand the potential of open data by sector. A true understanding of potential, however, cannot limit itself to a survey of existing companies. It must also consider the regulatory environment within which companies operate, as well as broader economic, social, and technological trends that may affect both a sector in general and the role of open data within that sector. It is based on this kind of broad, comprehensive analysis that we conclude open data offers the most potential for these four sectors:

1. Technology
2. Finance and Investment
3. Business and Legal Services
4. Health Care

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<sup>39</sup> James Manyika, Michael Chui, Diana Farrell, Steve Van Kuiken, Peter Groves, and Elizabeth Almasi Doshi, "Open Data: Unlocking Innovation and Performance with Liquid Innovation," McKinsey Global Institute, November 1213, [http://www.mckinsey.com/insights/business\\_technology/open\\_data\\_unlocking\\_innovation\\_and\\_performance\\_with\\_liquid\\_information](http://www.mckinsey.com/insights/business_technology/open_data_unlocking_innovation_and_performance_with_liquid_information).

<sup>40</sup> "Open Growth: Stimulating Demand for Open Data in the UK," Deloitte.



## FINANCE AND INVESTMENT

A total of 39 SMEs were classified as belonging to this sector. These are companies that use open data to provide financial information or analytics services, to ensure finance security, or to offer a range of consumer and personal finance applications, including those that help with consumer credit monitoring, financial consulting, and tax services. Once again, we found that most companies in this sector operated in the B2B space.

Companies in this sector used data from a variety of sources, including the Securities and Exchange Commission (19 companies), the Department of Commerce (12 companies), the Department of Labor (11 companies) and the Federal Reserve Board (11 companies). Companies in this sector generally benefit from a long history of data collection at the federal and state levels, allowing them to build on historical data collected by, among others, the SEC, the Consumer Financial Protection Bureau, the Department of Labor, and the US Census Bureau.

One important consideration for any company seeking to operate in this sector is the extensive web of regulatory and legal requirements that apply to finance data. Among other obligations, companies dealing with finance data must conform to Consumer Information Protection, and a variety of SEC regulations that require firms to have policies and procedures addressing the protection of customer information and records.<sup>41</sup> In addition, and despite the widespread adoption of XBRL standards across the sector, there is an ongoing debate within government about the need for a stronger regulatory framework that would, among other issues, ensure more stringent data standards and require increased risk reporting from financial institutions.

Our case studies include a number of companies using finance-related open data. These include:

- ▶ Brightscope, which uses data from the Department of Labor and the SEC to provide a search engine for users to evaluate the fees charged by different pension plans. The company also helps employers and employees make better decisions in choosing retirement and wealth-management plans.<sup>42</sup>
- ▶ NerdWallet, which uses data from the Department of Health and Human Services and the Department of Commerce to create user-friendly tools that help consumers answer questions and make data-driven decisions about their money.<sup>43</sup>
- ▶ OnDeck, an alternative lending company, which uses financial data provided by a number of different government sources to evaluate the financial health of small and medium-sized businesses, and to automate the underwriting process and provide short-term loans.<sup>44</sup>

## BUSINESS AND LEGAL SERVICES

Twenty-eight of the 354 SMEs analyzed from the Open Data 500 operate in this space. Companies in this sector usually provide solutions for businesses and consumers related to business software and analytics, consulting and strategic services, supply chain management, and news and information. In addition, they include ratings and review sites that help customers choose among businesses or legal service providers.

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<sup>41</sup> "Customer Information Protection," Finra.

<sup>42</sup> "Brightscope," OpenData500 GovLab.

<sup>43</sup> "NerdWallet," OpenData500 GovLab.

<sup>44</sup> "OnDeck," OpenData500 GovLab.

The vast majority of companies in this sector relied on data provided by the Department of Commerce (22 data sets), followed the Department of Energy (7 data sets), the Department of Labor (6 data sets), the Department of the Treasury and the Department of the Interior (5 data sets each). As with finance SMEs, companies in this sector are subject to a wide range of legal and regulatory requirements, including obligations to protect consumer privacy and ensure the security of data. Also as with finance companies, many of the SMEs here rely on SEC data, much of which is of questionable quality and accuracy. Indeed, the need for more accurate business and finance data is one of the chief challenges confronting open data SMEs in these two sectors.

Examples of companies in this sector include:

- ▶ Avvo, which uses multiple government open data sources to create a database and search engine for consumers and businesses to identify the best lawyers for their particular needs.<sup>45</sup>
- ▶ Panjiva, which uses data from the Department of Homeland Security (US Customs Service)<sup>46</sup> and many other sources to provide in-depth information on hundreds of thousands of manufacturers around the world, thus enabling businesses to connect across borders.<sup>47</sup>
- ▶ Way Better Patents, which uses open patent data to chronicle the latest developments in intellectual property, inventions, and patents in order to provide custom reports and analysis related to the innovation economy.<sup>48</sup>

## HEALTH CARE

Accounting for 27 of the 354 companies we studied, companies in this sector generally provide patient-centered hospital and research services (e.g., health care data storage, management, and analytics), personal health data management, outcomes research, and referral management solutions. Companies operating in this sector benefit from a wave of interest in using technology for health care, including through electronic patient health records and better reporting systems to increase economic efficiency and minimize adverse effects and other negative health outcomes.

Over the years, a number of public data sets have been made available for data-driven health-care companies. These include research and clinical data (described above, in Question 3), as well as data from a variety of government sources, especially the Department of Health and Human Services (a total of 75 different data sets from the DHHS were used by companies in our survey). More recently, the CDC has also begun releasing data, for example, through its online data portal (Data.CDC.gov).<sup>49</sup> Companies using any of this data must conform to the Health Insurance Portability and Accountability Act (HIPAA), and especially its provisions concerning privacy, security, and breach notification rules.<sup>50</sup>

Examples of open data companies in the health-care sector:

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45 Avvo, <http://www.avvo.com>, accessed November 12, 2014.

46 "Panjiva: Using Government Data as a Platform for International Trade," VentureBeat, July 20, 2009, <http://venturebeat.com/2009/07/20/panjiva-using-government-data-as-a-platform-for-international-trade/>, accessed November 12, 2014.

47 "Panjiva," OpenData500 GovLab, <http://www.opendata500.com/us/Panjiva/>, accessed November 12, 2014.

48 "WayBetterPatents," OpenData500 Govlab, [opendata500.com/us/waybetterpatents](http://opendata500.com/us/waybetterpatents), accessed November 12, 2014.

49 "2013 Year in Health Data Highlights," HHS.gov Digital Strategy, <http://www.hhs.gov/digitalstrategy/digitalstrategy/open-data/2013-health-data-highlights.html>, accessed November 12, 2014.

50 "Health Information Privacy," U.S. Department of Health & Human Services HHS.gov, <http://www.hhs.gov/ocr/privacy/>.

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- ▶ Propeller Health uses inhaler sensors, mobile apps, and data analytics to help doctors identify asthma patients in need of assistance; it combines individualized personal health information (e.g., from patient records) with information from the Department of Health and Human Services.<sup>51</sup>
- ▶ Aidin, a health-care referral management system, uses data from the Department of Health and Human Services, as well as data provided by Medicare-certified home agencies and Nursing Home Compare, to identify the best post-acute care providers for patients.<sup>52</sup>
- ▶ Evidera uses data from the Department of Health and Human Services to provide health economics, outcomes research, market access, and health research and consulting services to help clients (mainly health-care providers) optimize their businesses.<sup>53</sup>

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51 "Propeller Health," *OpenData500 GovLab*, <http://www.opendata500.com/us/Propeller-Health/>, accessed November 12, 2014.


52 Aidin, <http://www.myaidin.com>, accessed November 12, 2014.

53 "Overview & Mission," Evidera, <http://www.evidera.com/overview-mission/>, accessed November 12, 2014.

# 5. In What Market Segments Is Open Data Being Used?

Any effort to develop an open data business strategy arguably begins by identifying the right customer and market segment. Market segments can help define a product and focus plans for investment, publicity, and customer outreach. Based on our analysis of companies in the Open Data 500, we have identified these three market segments as offering the most promise for SMEs considering using open data:

- 1. Business-to-Consumer (B2C)
- 2. Business-to-Business (B2B)
- 3. Business-to-Government (B2G)

MARKET SEGMENT		NUMBER OF COMPANIES	
B2B	138		
B2C	96		
B2G	18		
B2G/B2C	9		
B2B/B2C	35		
B2B/B2G	33		
B2B/B2G/B2C	12		
B2B/B2G/B2C/Other	3		
Other	6		
Unkown	4		
TOTAL	354		

## BUSINESS-TO-CONSUMER (B2C)

Open data is often heralded as a democratizing phenomenon: it puts the power of information in the hands of ordinary citizens. Although the extent of democratization can be exaggerated, there is little doubt that one of the key opportunities—both social and commercial—represented by open data is the ability to reach and target ordinary consumers. According to the previously mentioned report by Deloitte, sectors that have “direct relevance to consumers” are likely to benefit most from open data. In addition, the report continues, “stimulating interest from consumer-driven businesses may yield the greatest economic benefit.”<sup>54</sup>

54 “Open Growth: Stimulating Demand for Open Data in the UK,” Deloitte. The report is referring specifically in this case to open government data, but the general observation is more widely applicable.

Of the 354 SMEs we studied, 92 served primarily B2C markets, and another 67 served B2C markets in conjunction with other market segments. These companies provided a wide range of services and products to consumers—everything from civic engagement platforms to college financing tools to credit monitoring. A number of B2C open data companies also operate in the area of decision-making support: they use open data to help consumers make more informed choices. BuildZoom, for example, aggregates data from a number of public (and other) sources to help consumers choose a contractor to remodel their homes. Credit Karma is a consumer finance company that enables consumers to monitor their credit ratings and evaluate potential credit, loans, and mortgages.<sup>55</sup>

## **BUSINESS-TO-BUSINESS (B2B)**

The single largest segment among SMEs included in our survey was the business-to-business segment. Out of the 354 companies we studied, 135 companies exclusively served the B2B segment, with another 75 targeting B2B in conjunction with other segments. The growth of this segment is being driven by a number of important technological trends. First, as with so many other aspects of our lives, business is itself subject to the increasing “datafication” of the economy and society; this means that a growing number of businesses rely on large amounts of data to conduct their operations. In addition, businesses, more than consumers, rely on what some have called “data as a service”<sup>56</sup>—data is sourced (from the cloud or from third-party providers) not just as raw data, but as a platform, accompanied by analytical and other tools that help derive maximum value from the data. The growth of this data-as-a-service industry represents a large business opportunity for SMEs operating in the B2B space. For example, it enables a company like Cambridge Semantics, a software suite that provides data solutions for businesses, to provide (and charge) its enterprise customers not just for the information provided, but for a suite of analytical and support tools as well.<sup>57</sup>

Other SMEs involved in similar activities include 5PSolutions, which uses open and shared data to develop software and mobile applications for its clients,<sup>58</sup> and Calcbench, which packages open SEC data with tools that allow companies to improve their own financial reporting practices as well as examine financial statements from other companies.<sup>59</sup> It is also worth noting what we might think of as a variation on the traditional B2B segment—businesses that sell data and services to noncommercial institutions (e.g., nonprofits rather than businesses). Often, the two segments overlap: Calcbench offers its services to academic and research institutions as well as businesses, and Civis Analytics, a big data analytics firm, also offers its services to different types of organizations, including private businesses, academic institutions (e.g., Arizona State University), and nonprofits (e.g., the Bill & Melinda Gates Foundation).<sup>60</sup>

## **BUSINESS-TO-GOVERNMENT (B2G)**

The B2G segment might more accurately be characterized as a G2B2G—SMEs operating in this segment often supplement the raw material of government data to provide analysis and other services back to government. Examples include Azavea, which uses data from the Department of Health and Human Services, the Department of Agriculture, the Department of

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<sup>55</sup> CreditKarma, <http://www.creditkarma.com>, accessed November 12, 2014.

<sup>56</sup> Omar Tawakol, “The Next Big Thing in Modern Marketing: Data as a Service,” *Forbes*, July 22, 2014, <http://www.forbes.com/sites/oracle/2014/07/22/data-as-a-service-get-more-data-value-without-all-the-headaches/>; David Linthicum, “Why Data-as-a-Service Has Taken Off So Fast,” *InfoWorld*, February 18, 2014.

<sup>57</sup> “About Us,” Cambridge Semantics.

<sup>58</sup> “About Us,” 5PSolutions, <http://www.5psolutions.com/about-us.html>, accessed November 12, 2014.

<sup>59</sup> “Corporate Reporting,” Calcbench, [http://www.calcbench.com/home/corporate\\_reporting](http://www.calcbench.com/home/corporate_reporting), accessed November 12, 2014.

<sup>60</sup> “Our Work,” CivisAnalytics, <https://civisanalytics.com/work/>, accessed November 12, 2014.

Commerce, and the Department of the Interior—among other sources—to provide geospatial and visualization services to a number of US government agencies, including the Philadelphia Police Department, the National Science Foundation and the US Army Corps of Engineers.<sup>61</sup> Likewise, BaleFire Global adds value to data by providing open data training and strategy, as well as implementation and custom design, to NGOs and governments around the world.<sup>62</sup>

Many governments release data with the explicit intention of encouraging such businesses. In launching its open data portal, for instance, the city of Houston has stated a desire to partner with private sector entities that will use and add value to public sector data.<sup>63</sup> Similarly, the city of New York includes a developer portal that provides APIs for city data “that developers can use to create apps to improve the lives of New Yorkers and the way in which City government serves them.”<sup>64</sup> Such examples illustrate the virtuous cycle that can be unleashed when governments decide to release data to the public: the benefits go beyond openness and transparency (though those are valuable in and of themselves), extending to the creation of new businesses and jobs *and* more efficient and responsive governance.

## 6. What Are Four Important Steps that SMEs Can Take to Add Value to Open and Shared Data?

Open and shared data is typically released as raw data, often in .CSV format. While such raw data has intrinsic usefulness, the real service being offered by SMEs—and the basis for the open data economy—is in the value they add through software, platforms, and analytical tools. In this section, we examine four steps that SMEs can take to add value to raw open data:

1. Cleaning and standardizing data
2. Consolidating and organizing data
3. Augmenting data through linking and aggregating
4. Data analysis

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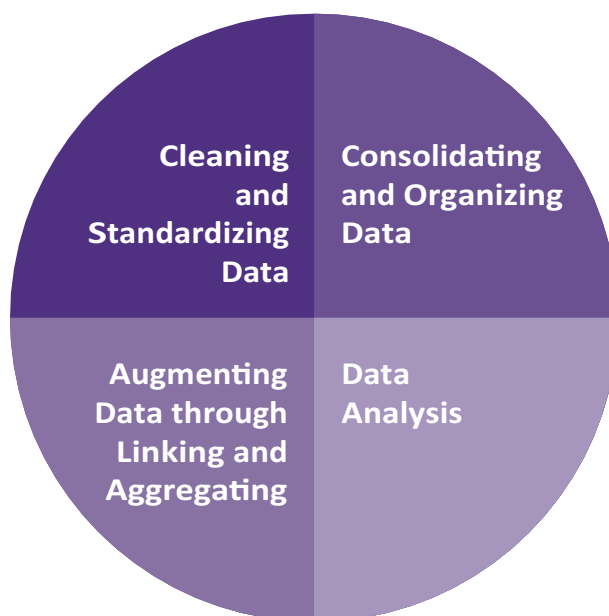
<sup>61</sup> “Azavea,” *OpenData500 GovLab*.

<sup>62</sup> “Our Solutions,” *BaleFire Global*, <http://www.balefireglobal.com/open-data-deployments/>, accessed November 12, 2014.

<sup>63</sup> Molly Ryan, “City’s Open Data Initiative Aims to Spark New ‘B2G’ Tech Sector,” *Houston BizBlog*, February 6, 2014.

<sup>64</sup> “Technology & Public Service Innovation: Open Data,” *NYC Information Technology & Telecommunications*, accessed November 12, 2014.





## CLEANING AND STANDARDIZING DATA

Many data sets released to the public suffer from problems related to quality—inaccuracies, duplication, and other forms of data corruption. In addition, two or more databases released from a common source (or from a time series) may be inconsistent or incompatible in ways that make them difficult to compare or use together.

One of the most important tasks for any organization or individual seeking to use open data is therefore that of cleaning and standardizing the data once it has been released. In some cases, this role is explicitly part of the business proposition of the SME. Calcbench, for instance, offers value to its customers through its efforts to clean and standardize SEC data, which is often incomplete or suffers from inconsistencies (e.g., errors in period-to-period financial reporting). Even businesses that offer higher-level analytical and processing tools for data must often begin by investing substantial resources in cleaning and standardizing. This is the case with Enigma.io, a search engine for open data, which enables connections and comparisons among data in nonstandardized formats. Data quality and standardization are among the chief goals and major challenges confronting the company, which is now an active member of the Data Transparency Coalition, an advocacy group pushing for uniformity in public data formats.

It is worth mentioning that not all data needs to be cleaned before use, and that the quality of data can vary quite widely by source. For instance, genomic data is generally provided in a standardized, machine-readable format; it requires little (if any) cleaning or standardizing by third-party users. By contrast, and as noted, SEC data is often of variable quality. Though all government data must, in theory, conform to the Data Quality Act of 2001, some sectors are more advanced in their data cleaning and release procedures. SMEs using data from the Department of Energy, for instance, benefit from a set of mandatory procedures that must be followed before data is released and that help ensure the quality of the data.<sup>65</sup>

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65 "Procedures for Public Release of Data," Energy.gov, <http://energy.gov/data/procedures-public-release-data>, accessed November 12, 2014.

## CONSOLIDATING AND ORGANIZING DATA

The term “consolidation” refers to the collection and integration of data from multiple sources into a single destination. When data is consolidated, different data sources are put together, or consolidated, into a single data source.<sup>66</sup> An important point to note is that consolidation is different from aggregation (which we discuss below). While aggregation refers to a process by which data is summarized (e.g., used to build a report or rating), consolidation is the grouping together of previously separate data.<sup>67</sup> In many cases, consolidation is an initial step necessary for aggregation.

For example, a company such as Aunt Bertha, a certified B Corporation and search engine for finding human services information, consolidates data from across government agencies, placing it within a single destination or data store. Conversely, data aggregation is any process that produces information in a summarized form for purposes of reporting or analysis, such as through a score on a rating and review site, like BuildZoom, or as a report or summary, such as those provided by data analysis and consulting services. In other words, aggregated data often depends on consolidated and organized data.

While consolidation is an important processing step for SMEs using open data, many companies are also created with the specific purpose of consolidating data. These companies base their business models around consolidating data from different sources. For example, they create searchable databases and data portals, and offer targeted search engines containing consolidated data pertaining to a specific purpose or vertical (e.g., information related to retirement and pension plans). BetterLesson is one such company: it offers a searchable database for teachers researching Common Core curriculums, and includes data from the Department of Education. Aunt Bertha is another example. It provides a search engine for finding human services information and social programs; its offerings include, for instance, a searchable database to find free and low-income services that help with food, housing, goods, transit, health, education, legal needs, and a variety of emergencies.<sup>68</sup>

## AUGMENTING DATA THROUGH LINKING AND AGGREGATING

Data sets that have been cleaned and standardized can be augmented (i.e., increased in value) by combining them with other data sets. This process of aggregating or linking data often takes place across sectors—for instance, by combining government data sets with shared corporate data or open science data. This process of augmentation can add context and relevance to data, and it can also enable linkages or connections that increase the value of information that previously existed in silos.

An SME can augment a given data set either with *internal* data or with *external* data sourced from other institutions. Internal data includes data generated within the SME itself. External data can come from a variety of sources, including other open data sets; crawled or scraped data, which can be structured or unstructured (e.g., information from review sites or social networks); and crowdsourced data, which often requires a tool or platform that allows users and consumers to augment the data by adding their own insights or wisdom. Importantly, the augmented data need not itself be open: companies can add value to open data by linking it to proprietary data sets (although sharing and licensing the aggregated data can sometimes be complicated).

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66 “Data Consolidation,” Techopedia, <http://www.techopedia.com/definition/28034/data-consolidation>, accessed November 12, 2014.

67 For instance, Aunt Bertha, a search engine for finding human services information, consolidates data from across government agencies, placing it within a single destination or data store. A company like BuildZoom, on the other hand, aggregates data: it produces information in a summary form for purposes of reporting or analysis, such as through a score or a rating. For more on the difference between consolidation and aggregation, see <https://www.imf.org/external/pubs/ft/fsi/guide/2006/pdf/chp5.pdf>.

68 Aunt Bertha, [https://www.auntbertha.com/get\\_directory?postal=11237#emergency-emergency\\_food](https://www.auntbertha.com/get_directory?postal=11237#emergency-emergency_food), accessed November 12, 2014.

The variety and breadth of data used for augmenting is emerging as a major strategic factor for many companies, helping differentiate products and platforms from the competition. Almost all the companies included in our case studies augment data in one form or the other. Three examples are illustrative:

1. BuildZoom, which matches homeowners and contractors, combines and summarizes data from both public and private sources to produce a score for contractors that homeowners can use to inform their hiring decisions.
2. Using a proprietary relational engine, Enigma.io systematically links or connects its wide variety of data sources in order to make searching for data easier and more reliable.<sup>69</sup>
3. Cloudmade, a platform for geospatial data, supplements its data from the Department of Commerce and other government sources with location-based content purchased from data providers. It gives users the capacity to import data (via APIs) from social media sites like Yelp and Foursquare, as well as from traffic data suppliers, gas price suppliers, and weather providers.<sup>70</sup>

## DATA ANALYSIS

One of the most important functions performed by open data SMEs is that of analysis (or of offering tools that allow customers to perform analysis). Analysis enables insight and meaning—it adds what we might think of as multidimensionality, permitting raw *data* to become *information*. Analysis is also what allows data-enabled decisions and actions. As SMEs develop more refined and innovative analytical tools (for instance, relying on more sophisticated visualizations), the insights and actions that can be taken on the basis of data will become increasingly sophisticated.

Data analytics undertaken by SMEs can be broadly divided into three categories: descriptive, predictive, or prescriptive.<sup>71</sup> Descriptive analytics are the most basic form of analysis, and essentially summarize a given data set. A descriptive analysis might include, for example, the number of logins on a website, or the number of consumers within a certain demographic contained within a data set. According to one data expert, “more than 80% of business analytics . . . are descriptive.”<sup>72</sup> As an example, Alarm.com, a provider of connected home services, gives its users a dashboard containing information pertaining to home security and energy management, and uses push notifications to provide descriptive analytics to customers so that they can keep abreast of any changes at home as well as historical use patterns.<sup>73</sup>

Predictive analytics are more sophisticated forms of analysis that use modeling, data mining, and machine learning techniques to draw inferences about possible outcomes and future events. Roadify, a public transit application, is an example of a SME using predictive analytics: it studies aggregated data to make predictions for travelers about which routes are likely to take the least time. Predilytics is another example: it uses data from the Department of Health and Human Services, along with individual patient data, to help health plans, care management organizations, Accountable

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69 “About,” Enigma.io, <http://www.enigma.io/about>, accessed November 12, 2014.

70 “Hybrid Data,” Cloud Made, <http://cloudmade.com/technologies/hybrid>, accessed November 12, 2014.

71 “Descriptive, Predictive, Prescriptive: Transforming Asset and Facilities Management with Analytics (White paper (external)-USEN),” IBM Software: Thought Leadership White Paper, October 2013, <http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=SA&subtype=WH&htmlfid=TIW14162USEN#loaded>; Jeff Bertolucci, “Big Data Analytics: Descriptive vs. Predictive vs. Prescriptive,” InformationWeek, December 31, 2013, <http://www.informationweek.com/big-data/big-data-analytics/big-data-analytics-descriptive-vs-predictive-vs-prescriptive/d/d-id/1113279>.

72 Jeff Bertolucci “Big Data Analytics: Descriptive vs. Predictive vs. Prescriptive,” InformationWeek, December 31, 2014, <http://www.informationweek.com/big-data/big-data-analytics/big-data-analytics-descriptive-vs-predictive-vs-prescriptive/d/d-id/1113279>.

73 Jennifer Van Grove, “Hey Control Freaks, Alarm.com Has a Home System for You,” CNET, January 6, 2013.

Care Organizations (ACOs), and other health-care organizations understand members' needs, target care management resources, and capture risk across populations.<sup>74</sup>

Roadify also uses a technique known as prescriptive analytics. Prescriptive analytics go one step further than predictive analytics—they not only predict what is likely to occur, but, based on such predictions, suggest (or prescribe) a course of action. Prescriptive analytics are also used by companies like Aidin, which use open data to prescribe the best post-acute provider to serve patient needs; or Avvo, which suggest a lawyer based on a rating and ranking algorithm determined by user reviews, legal needs, location, and legal specialty. A number of other companies similarly suggest or recommend actions to users, in theory enabling them to make more sophisticated policy, financial, nutritional, and other kinds of decisions.

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<sup>74</sup> Predilytics, <http://www.predilytics.com/value-we-create/overview/>, accessed November 12, 2014.

## 7. What Types of Products Are Being Created Out of Open Data?

SMEs relying on open data typically use it in two ways: to build new services and/or to optimize existing services or processes. We have analyzed the 354 SMEs in the Open Data 500 database to arrive at a better understanding of the types of products that are most often being developed. Needless to say, this is just a sampling, and companies are regularly developing new, innovative products that do not fit into of these categories. Nonetheless, this list of products and services may serve as a useful guide for companies considering entering the open data space.

Broadly, we found six types of open data products being developed by SMEs:

### **ANALYSIS, INSIGHT, AND DECISION-MAKING SUPPORT**

A number of companies have developed data-driven products and platforms to help businesses, consumers, and governments make better and more informed decisions. These companies promote improved decision making through tools like ratings and reviews (especially popular for consumer products), data-driven recommendations and suggestions, and other forms of data analysis. The analysis is usually based on aggregated data and “scores” drawn from a variety of sources, including consumer reviews, open data, proprietary or acquired data, and crowd-sourced data.

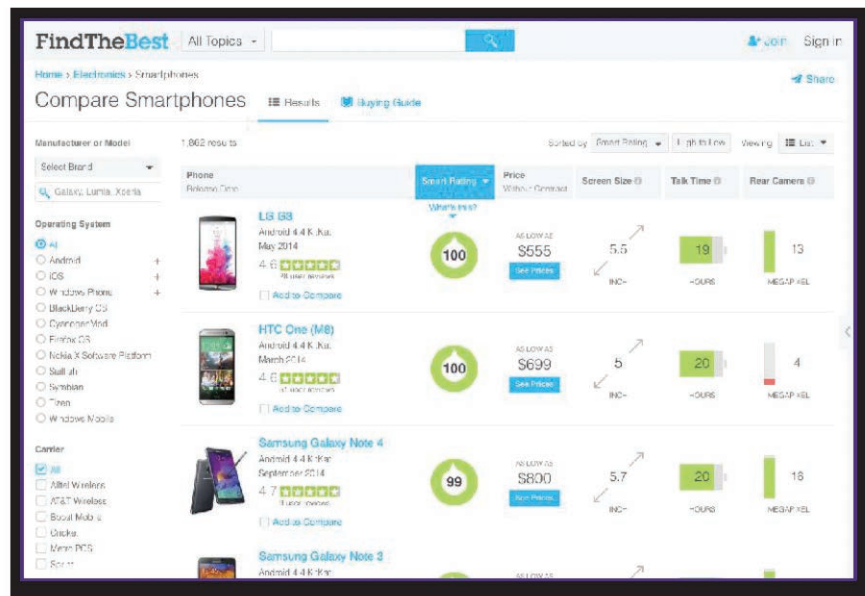
- ▶ Aidin is one example of a B2B product that provides decision-making support. A platform to help patients and hospital administrators make decisions regarding post-acute care, it integrates and aggregates data from various HHS open data streams, as well as patient reviews, to suggest outpatient, post-acute providers that are best suited to a patient’s specific needs.<sup>75</sup>
- ▶ FindTheBest, a comparative search engine, uses data from over 30 different government departments to help consumers compare features and prices of similar products and make more informed decisions.<sup>76</sup>
- ▶ BuildZoom, a website that matches home owners and building contractors, uses crowdsourced ratings and reviews, as well as scores generated from aggregated Better Business Bureau data, to help property owners find contractors that fit their needs.

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<sup>75</sup> “The Aidin Product Suite,” Aidin, <http://www.myaidin.com/learnmore.html>, accessed November 12, 2014.

<sup>76</sup> FindTheBest, <http://www.findthebest.com>, accessed November 12, 2014.

**Example:** FindTheBest's Comparative Search Engine for consumer decision-making support.

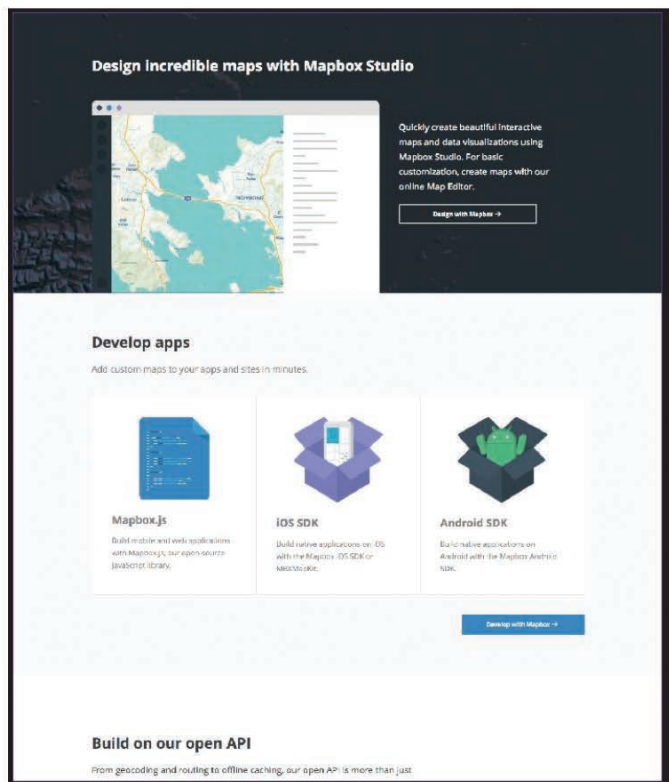
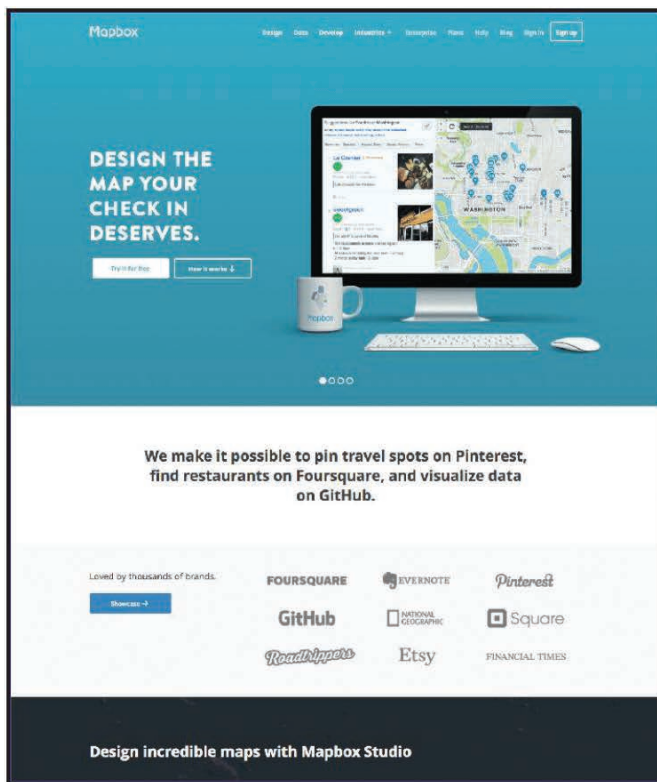


## DATA INTERFACES AND VISUALIZATION PLATFORMS

This category of products is one of the largest being developed by SMEs in our analysis. Companies in this space are increasing access to data through new interfaces and visualization tools (e.g., search engines or interactive analytics applications), many of which are available through cloud-based platforms. While these platforms can, like the previous category of product, help users improve decision making, that is typically not their main objective; rather, they are focused on providing users with clearer access to, and a better understanding of, information.

- ▶ CitySourced, a civic engagement platform that citizens use to find and report civic issues, is compatible with Windows, Android, Apple, and BlackBerry mobile operating systems, and enables users to report issues like graffiti on public property, illegal parking, and public dumping, and uses a mapping interface to locate reported problems in real-time. Enigma.io provides an interface that allows users to search a variety of open data sets. Its interface provides users with tools to manipulate data (for example, how data is viewed) by grouping, filtering and performing basic statistical analysis on it.
- ▶ Mapbox is an open source platform that uses data from a variety of government sources to help users design and publish maps and geographical data. The company provides custom services for a wide variety of businesses, and also offers a platform that developers and others can use to create their own maps and geospatial visualizations.

**Example:** Mapbox's geospatial data visualization platform.



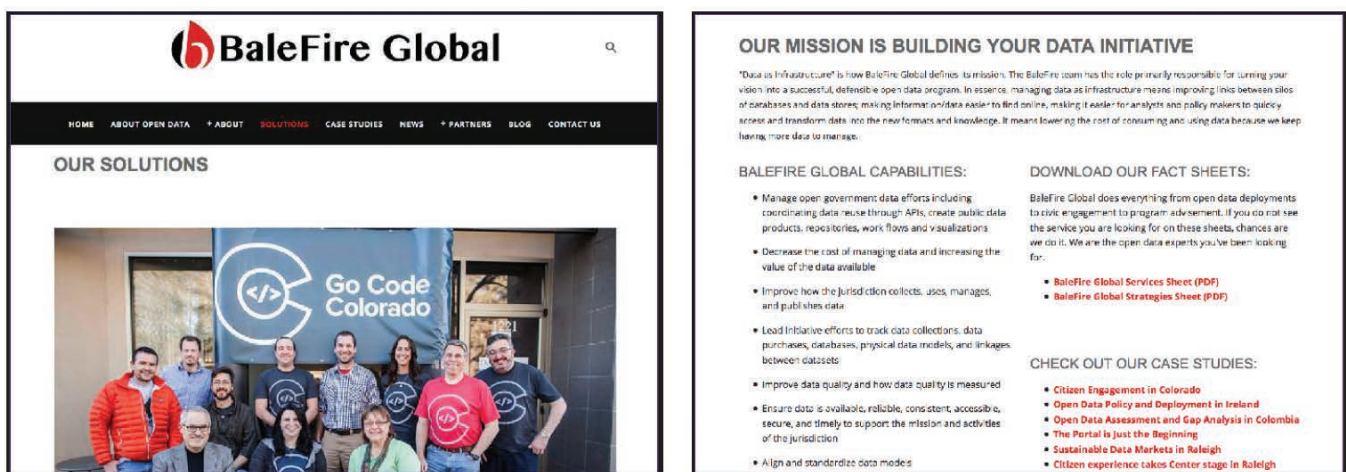


## CONSULTING SERVICES

Several consulting businesses use open data to inform their recommendations to clients, particularly in the areas of business and finance, technology, health care, and education. In addition, some companies (e.g., BaleFire Global) have been developed specifically around the business of providing consulting services regarding the optimal use of open data.

- ▶ BaleFire Global provides consulting services and training programs to governmental, nongovernmental, and private organizations to help them build, manage, and deploy their open data initiatives.<sup>77</sup>
- ▶ Certara offers a broad spectrum of scientific consulting services and software products. It is focused on the health care and pharmaceuticals space, and uses data from the Department of Health and Human Services to inform its consulting practice and recommendations.<sup>78</sup>
- ▶ Analytica provides IT and consulting services to US public sector clients. It specializes in delivering solutions that help government organizations manage, analyze, leverage, and protect information.<sup>79</sup>

**Example:** BaleFire Global is an example of a consulting company providing services in the area of open data portal deployment.



77 "Our Solutions," BaleFire Global, <http://www.balefireglobal.com/open-data-deployments/>, accessed November 12, 2014.

78 Certara, <http://www.certara.com/>, accessed November 12, 2014.

79 Analytica, <http://www.analytica.net/>, accessed November 12, 2014.



## DATA-DRIVEN PRODUCTS

Open and shared data provides an ancillary role for a small portion of the companies studied, which use open data for the creation of products not specifically related to data or data analysis. These products do not necessarily provide users access to data, nor do they provide tools for B2C or B2B decision-making support. Rather, the company uses open data to create products out of data, but separate from the data itself, such as financial products in the form of loans.

- ▶ OnDeck is an alternative lending company that uses open data, among other data, to automate the underwriting company to provide loans to small and medium-sized enterprises.
- ▶ Pave uses data from a number of different US government agencies, including those at the federal (such as the US Census Bureau and Bureau of Labor Statistics) and state levels (in the post-Completion Wages of Graduates) to provide loan rates to individuals seeking personal loans from backers, to pay off student debt, pursue career opportunities, or take their careers to the next level.<sup>80</sup> The loans are provided by individual investors who give a one-time payment in exchange for a small portion of the individual's income.
- ▶ Climate Corporation, now part of Monsanto, uses open data to determine insurance rates for farmers who are seeking to protect their agricultural investments in the case of extreme weather.<sup>81</sup> The company also uses machine learning to predict optimal weather conditions for planting and other agricultural activities.

**Example:** Climate Corporation's open-data-driven product, Total Weather Insurance.



80 "Pave," OpenData500 GovLab.

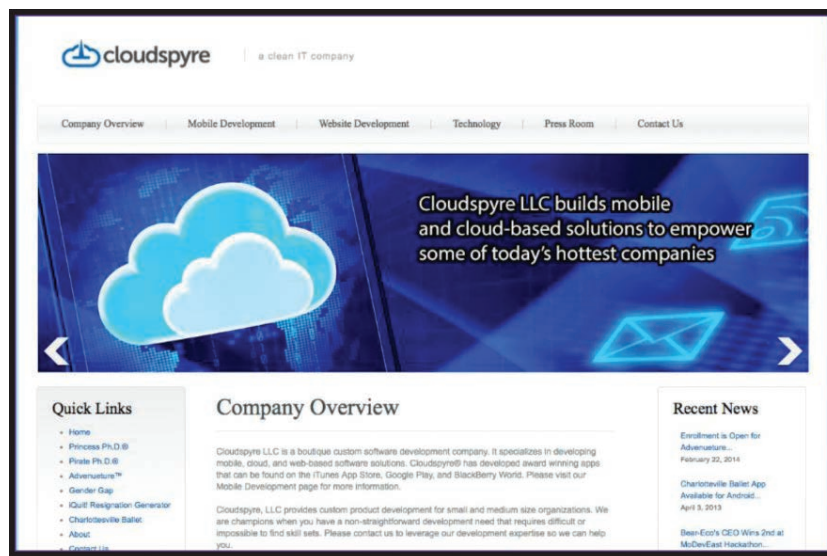
81 Alexia Tsotsis, "Monsanto Buys Weather Big Data Company Climate Corporation for Around \$1.1B," TechCrunch, October 2, 2013.

## SOFTWARE, WEB, AND MOBILE APPLICATION DEVELOPMENT AND SERVICES

Several companies use open and shared data to build software, web, and mobile applications and services. Many of these open-data-driven applications and services are marketed on a B2B basis. They include custom software and application development, deployment of software (e.g., open source software), data portals, and software development tools that, for example, empower a business's customers to transform and edit their own information. A large number of these companies also specialize in the creation of tools for data management and analysis.

- ▶ Altova is a standards-based platform that provides tools to help customers create, access, edit, and transform their information resources.<sup>82</sup> The company has, for example, used data from the Securities and Exchange Commission to build its platforms and related applications.
- ▶ Cloudspyre is a boutique custom development firm that specializes in developing mobile, cloud, and web-based software solutions. In the past, it has used data from the Department of Labor to build software for its clients.<sup>83</sup>
- ▶ Datamade is a civic technology company that specializes in providing open source software services for government and other clients. The company uses a variety of open data resources, depending on the client's needs.

**Example:** CloudSpyre builds mobile and cloud-based software solutions.



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<sup>82</sup> Altova, <http://www.altova.com>, accessed November 12, 2014.

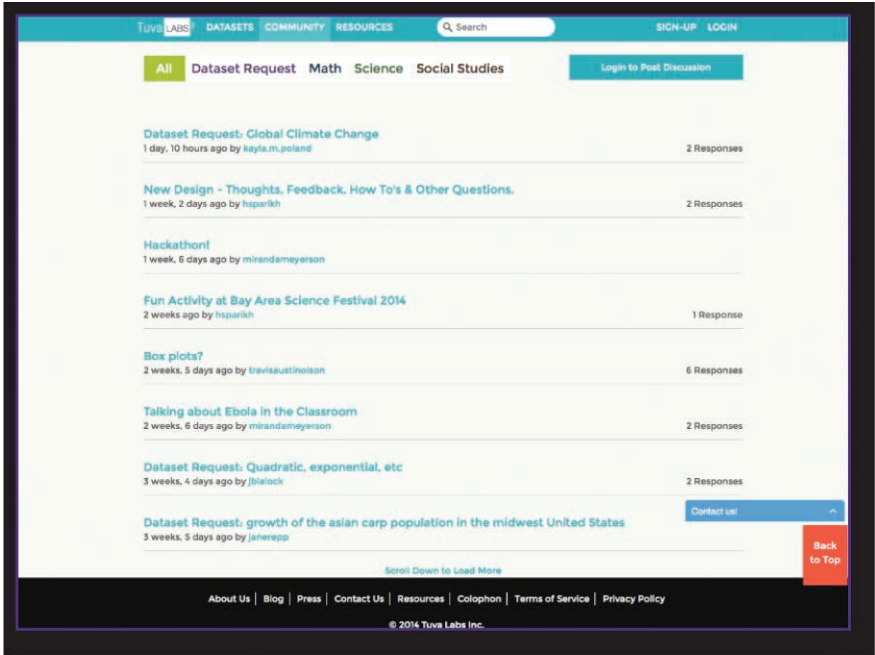
<sup>83</sup> "Cloudspyre," OpenData500 GovLab.

EDUCATIONAL SERVICES AND MATERIALS

A small number of the companies we studied focus on providing online education and courses to increase digital literacy. These companies use open data as a free educational resource to teach students how to analyze and interpret data, and how to build applications to automate these processes.

- ▶ Tuva Labs is one example—an online educational platform that helps improve data literacy skills. Both teachers and students can use the service.<sup>84</sup> The company uses open datasets to teach students and teachers how to visualize, analyze, and interpret data.
- ▶ TopCoder is a learn-to-code application that uses prizes, challenges, and competitions to help drive users to learn to code.<sup>85</sup> TopCoder also makes use of open data as a resource to help teach basic elements of data science.

**Example:** Tuva Labs uses open data to teach students about data literacy.



84 Tuva Labs.  
85 [topcoder], <http://www.topcoder.com/>, accessed November 12, 2014.

## 8. How Are SMEs Monetizing Their Open Data Products and Services?

Few issues are as important for SMEs using open data as the question of how to generate revenues. Revenue models are intimately tied to questions about product, market segment, and customers. Each of these variables will play an important role in determining how SMEs monetize their products and services.

After scanning existing open data revenue models (both from within and in addition to the Open Data 500), we find that they can broadly fit into one of the following seven categories:

### SUBSCRIPTION

Prevalent mainly in a B2B context, a number of SMEs provide access to their products and services on a subscription-based model. Subscriptions can include payments for raw data streams, but typically such streams are also bundled with value-added services (e.g., for analytics) not offered to nonpaying customers. Subscription-based models are a time-proven strategy and have the advantage of generating long-term, recurring revenue streams.

- ▶ Calcbench is an example of an open data business based on a subscription model. It charges premium users \$300 per user per month, or \$3,000 yearly.
- ▶ Fastcase, a legal research and visualization service, is another example of a business that relies on subscriptions. It offers two plans and monthly and annual rates that range \$65/month to \$995/year.<sup>86</sup>

### ADVERTISING

Revenue streams based on advertising are another time-proven strategy that predates the digital age. Typically, companies that rely on advertising interface with a wide consumer base (thus operating in the B2C segment), as they rely on a large volume of users to generate revenues. Advertising is rarely sufficient as a revenue stream; it is often combined with other streams, in an illustration of what McKinsey calls a “multisided business model.”<sup>87</sup>

- ▶ BuildZoom is an example of a business that uses advertising. Advertisements are typically placed on the side of search results and are tailored to specific regional markets.
- ▶ FindTheBest is another company that uses an advertising-based business model. Its algorithms rely on search queries made within the site, as well as through other search engines, to determine what products and services to display in advertisements.

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<sup>86</sup> “Pricing & Sign Up,” Fastcase, <http://www.fastcase.com/subscription/>, accessed November 12, 2014.

<sup>87</sup> Jacques Bughin, Michael Chui, and James Manyika, “Clouds, Big Data, and Smart Assets: Ten Tech-Enabled Business Trends to Watch,” McKinsey & Company, August 2010, [http://www.mckinsey.com/insights/high\\_tech\\_telecoms\\_internet/clouds\\_big\\_data\\_and\\_smart\\_assets\\_ten\\_tech-enabled\\_business\\_trends\\_to\\_watch](http://www.mckinsey.com/insights/high_tech_telecoms_internet/clouds_big_data_and_smart_assets_ten_tech-enabled_business_trends_to_watch).

## FEES FOR PRODUCTS AND SERVICES

In this model, companies charge customers (whether individuals or businesses) a set fee for their consumption of a particular service. A wide range of services can be included—everything from software development to consulting to web design. This revenue model is, in effect, the closest to a traditional “purchase”-based model among the various models described here, although digital technology permits easier metering of consumption (so that customers can be charged, for instance, based on their units of consumption). Technology also makes it easy for companies to segment their customers, charging them different amounts based on their perceived abilities to pay. For example, a nonprofit or individual customer may be charged less than a corporate customer.

- ▶ Azavea charges service fees for a number of different custom services, including research and development, spatial analysis and mapping, spatial data mining, modeling and distributed computing, systems integration, and strategic planning and architecture design, as well as web and mobile application development.<sup>88</sup>
- ▶ Development Seed offers a range of services, such as web and mobile application development, data management and analysis, and visualization services. It uses a number of different data sources, including open government data from the Department of Commerce and the US Census Bureau, and data from the World Bank and Open Street Map, to deliver custom solutions and services.<sup>89</sup>
- ▶ Business and Legal Resources, a compliance and regulation consulting agency, offers several products for sale in its online store, including audit checklists, HR guides, and reports. The company also offers software and consulting services, and uses a range of open data, including data from the Department of Labor (Bureau of Labor Statistics) and the US Equal Employment Commission.<sup>90</sup>

## FREEMIUM

Freemium revenue models have gained popularity on the Internet and are a way of combining free products or services with value-added services for which customers are charged. Freemium has proven to be a particularly popular strategy in the digital world because of the low marginal cost of producing and distributing goods; it is therefore far more viable for businesses to distribute a certain portion of their goods without charge in order to build a customer base.

- ▶ Calcbench is one example of a company that operates a freemium model. Although the company charges for its core products, nonpaying users are able to access a number of products, such as Company in Detail and the XBRL Filer Information Portal.<sup>91</sup>
- ▶ Caspio, an online platform for building custom applications, also uses a freemium model, offering a Personal account with limited features, and Business and Corporate accounts, which are available for \$249/month and \$999/month respectively.<sup>92</sup>

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88 “Services,” Azavea, <http://www.azavea.com/services/>, accessed November 12, 2014.

89 “Projects,” Development Seed, <http://www.developmentseed.org/projects/>, accessed November 12, 2014.

90 “Featured Projects,” BLR Store, <http://store.blr.com/index.php>, accessed November 12, 2014.

91 “Premium Suite Pricing,” Calcbench, <http://www.calcbench.com/payment/pricing>, accessed November 12, 2014.

92 “Pricing,” Caspio, <http://www.caspio.com/pricing/>, accessed November 12, 2014.

## LICENSING FEES

Licensing is another popular strategy. Open data SMEs often find themselves in possession of a wealth of data that is potentially valuable to third-party organizations. This data can be licensed in raw form, leaving the seller to analyze it, or in processed form. Data can also be licensed along with analytical tools (e.g., through APIs), in a revenue model that combines licensing and subscription-based revenue streams. In addition, a number of SMEs use open data to develop software and database tools that are licensed to users, for example by providing downloadable software and products that can be registered with a product key by users.

- ▶ In 2012, Roadify licensed its New York city transit data to the Barclay's Center in Brooklyn. This data was broadcast on TV for fans attending events at the stadium.
- ▶ Junyo, the creators of EdLights, an educational marketplace data platform, licenses its software to K–12 schools to improve their organizational decision-making capacities.<sup>93</sup>

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93 EdLights, <http://edlights.com/product-overview>, accessed November 12, 2014.

## RAZOR AND BLADES

Also known as a “freebie,” the name of this model is derived from the well-known strategy pioneered by Gillette (and others) in which a low-cost or free initial product serves as bait to draw in customers who are then sold more expensive or premium products. It is similar to a freemium model, except that access to the initial product (the razor) often creates a need for the more expensive subsequent product (the blades).

- ▶ Credit Karma uses this model, providing free tools for consumers to monitor their credit ratings and debt, while offering loans, mortgages, credit cards, and other financial products that generate revenue for the company.<sup>94</sup>
- ▶ Enervee is a data and marketing platform that aims to find energy-efficient products. Using data from the Department of Energy, the Department of the Interior, the National Archives and Records Administration, and the US Environmental Protection Agency, it connects retailers, governments, and utilities to provide energy-efficient product recommendations for consumers and businesses.<sup>95</sup> The company offers a number of different products and services in addition to its free Enervee.com consumer web site, such as a Closed Loop Utility Rebate Program, an Energy Efficiency Market Data Service, and a Retail and Manufacturer Efficiency Score service.<sup>96</sup>

## PHILANTHROPIC GRANTS, DONATIONS, AND SPONSORSHIPS

While open data can create great economic value, it also holds the potential for tremendous social and public good. A number of organizations have therefore been able to productively deploy open data solutions relying on grants, donations, and sponsorships as a form of “revenue.” While the bulk of these organizations are nonprofit, they may also include B Corporations and even some for-profit organizations that combine grant money with more conventional revenue streams.

- ▶ Code for America is a nonprofit that partners with local governments and citizens to foster civic innovation through the development of web and mobile applications, as well as through training services. It is supported by a number of different foundations and grants, such as those provided by the Sunlight Foundation, the Omidyar Network, Nike, and Microsoft.
- ▶ Great Schools is a nonprofit organization that provides school performance information to parents, to help them find the right school for their children. The organization receives contributions from the Laura and John Arnold Foundation, the William and Flora Hewlett Foundation, the David & Lucile Packard Foundation, and others.

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<sup>94</sup> CreditKarma, <https://www.creditkarma.com/>, accessed November 12, 2014.

<sup>95</sup> “Enervee Corporation,” OpenData500 Govlab.

<sup>96</sup> “About,” Enervee, <http://enervee.com/about/>, accessed November 12, 2014.



III

# Measuring and Enhancing



Open data is a young and rapidly evolving field. Concepts and definitions remain in flux, and the practice—and best practices—that guide the use of open data are constantly changing. In addition, as the phenomenon spreads, new risks and challenges are becoming apparent. In truth, we know very little about this dynamic area of technical innovation.

This section attempts to look to the future. It seeks to establish metrics for measuring the impact of open data and to identify some of the key challenges SMEs will face in deploying open data. Asking such questions is an important step toward better understanding how open data can optimally be deployed.

## 9. How Can We Evaluate the Impact of Open and Shared Data on SMEs and the Wider Economy?

The link between open data and economic development is becoming increasingly clear, both within developed and developing countries. A recent World Bank paper examines a range of evidence for the economic potential of open data, concluding that “despite a variation in published estimates and some methodological difficulties, the potential is very large indeed.”<sup>97</sup>

Despite such examples and evidence, however, measuring the true impact of open data remains challenging. Many of the challenges are not specific to open data—issues of data quality, comparability, and semantic consistency are general problems researchers face when trying to establish metrics (especially comparative metrics) for development.<sup>98</sup> The economic impact of open data is also challenging to measure because of externalities and indirect effects that are difficult to capture. For instance, the social (e.g., governance or environmental) benefits of open data often translate indirectly into economic impact—but the pathways are complicated and difficult to disentangle. The World Bank suggests the measurement challenge when it concludes that “although the ‘direct’ economic benefit of the business providing data-rich services is significant, the majority of the overall benefit is ‘indirect’ in the sense that it accrues to the users of data-rich services . . . rather than the providers of those services.”<sup>99</sup>

In a report entitled “Market Assessment of Public Sector Information,”<sup>100</sup> the consulting firm Deloitte suggests that the economic effects of open data can helpfully be separated into three categories: direct impact, indirect impact, and social impact. Our model here expands on this taxonomy to suggest five different metrics that can usefully be applied to measuring the impact of open data for SMEs.

1. **The direct value of open data to SMEs**, including but not limited to the amount of revenue generated from the open data business, the cost savings associated with using open data instead of proprietary (and often expensive) research, the monetized time savings of open data, and the increased demand for the SME’s product or service that results from using open data.

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97 “Open Data for Economic Growth,” The World Bank, June 25, 2014, <http://www.worldbank.org/content/dam/Worldbank/document/Open-Data-for-Economic-Growth.pdf>.

98 “The Value of Research Data: Metrics for Datasets from a Cultural and Technical Point of View,” Knowledge Exchange.

99 “Open Data for Economic Growth,” The World Bank, June 25, 2014, <http://www.worldbank.org/content/dam/Worldbank/document/Open-Data-for-Economic-Growth.pdf>.

100 Deloitte, “Market Assessment of Public Sector Information,” Department for Business Innovation & Skills, May 2013.

**2. The indirect value of open data to third-party organizations** doing business with open data SMEs. Third-party organizations can benefit by using open data to optimize or gain new insights into their business practices. In addition, they may benefit through additional revenues generated and increased productivity.

**3. The indirect value of open data to consumers using open data SMEs** or third-party organizations using open data SMEs. This value is apparent in better targeting of products to consumers; improved consumer decision making based on the identification of potential savings in the marketplace; and more efficient consumer decision making (reflected, for instance, in lower prices or less time spent making decisions).

**4. The indirect value associated with open data SMEs on the wider economy**, through increased consumer spending or B2B expenditure, increased employment and productivity, greater innovation, and other macroeconomic benefits.

**5. The wider societal impacts that can be attributed to open data SMEs.** Such societal benefits can include increased access to data, positive environmental impact, new forms of democratic participation, increased consumer choice, and improved decision-making and policy insights within government.

Needless to say, there are inherent measurement challenges involved with all these forms of evaluation. As noted, the last metric category (“societal impacts”) is particularly difficult to identify and quantify due to the challenges of capturing externalities and indirect impacts. Nonetheless, this taxonomy serves as a useful starting point for thinking about—and ultimately measuring—the impact of open data on the wider economy and SMEs.

## 10. What Challenges Do SMEs Need to Overcome to Leverage Open Data for Value Creation?

Open data offers tremendous potential for SMEs, and this report has thus far mostly focused on the positive opportunities. However, there also exist a number of risks and challenges that SMEs will need to confront—and overcome—as part of their open data strategies. We have identified the following five as the most important of challenges.

**1. Challenges Collecting Data:** Many of the most difficult—but not intractable—problems confronting SMEs exist at the very first hurdle. Even before deploying open data or integrating it into their business strategies, SMEs typically face difficulties in finding and collecting open data.

These difficulties have multiple sources. Often, SMEs and their key employees (e.g., CIOs) suffer from a lack of awareness about the potential of open data. Often, too, SMEs may not know about the existence or availability of specific data sets. While governments and others may nominally release data sets to the public, companies and citizens often do not know about the existence of those data sets.

Incompatible or restrictive licensing terms can also represent a hurdle. As noted, open data exists on a spectrum of openness; in some cases, data that is publicized by its originating source as open may in fact come with a set of restrictive conditions that make it all but impossible for SMEs to use productively. Licensing incompatibilities between two or more

data sets can also prevent the full use of open data, which (as we have seen) depends on an ability to consolidate, link, and aggregate multiple data sets. A variation on this difficulty can also be found in a lack of harmonization between legal and regulatory norms in different jurisdictions. For example, different approaches to privacy in the United States and the European Union sometimes make it hard to combine open data sets from the two parts of the world.

Finally, the phenomenon of data protectionism also poses a challenge. For all the enthusiasm regarding open data, many entities continue to engage in data hugging: they restrict access to data, either by charging exorbitant fees or simply refusing to release it to the wider public. Sometimes data protectionism may have a legitimate basis: organizations may be concerned about the privacy implications of releasing data, and governments may worry about national security. Often, though, data protectionism is motivated simply by a desire to maintain a competitive advantage, or to withhold information from the public. It is our belief that such data protectionism unjustifiably limits the potential of open data and, in doing so, prevents its full economic benefits from being realized.

**2. Challenges Processing or Synthesizing Data:** SMEs can also face challenges in processing or synthesizing data on many fronts. Many of the licensing and legal incompatibility issues discussed above extend beyond the data collection stage; they can prevent or limit SMEs' ability to fully utilize open data.

In addition, open data often suffers from concerns over quality and accuracy. A 2014 study of 42 million open data records in the UK found numerous problems with what the study labeled "dirty data." Problems included incompatibilities in field names across data sets, 22 different filename conventions, and errors stemming from different encoding conventions.<sup>101</sup> Similar problems recently occurred in the United States when the government released some 4.4 million medical payment records. Citing errors and incompleteness, the website Politico characterized the data as a "sloppy release of partial information that will confuse rather than elevate understanding."<sup>102</sup>

A lack of universal technical standards can also limit SMEs' ability to process data. When Google attempted to use open data to set up a crisis map during Hurricane Sandy, it found itself navigating through incompatible and difficult-to-capture government data formats (e.g., information contained within PDFs). Since then, the company has advocated for a move to open data standards that could be used across departments and agencies.<sup>103</sup> Jeni Tennison, the technical director at the Open Data Institute, has likewise criticized government agencies that "all publish largely with different schemas, different structures for the data, [and that] interpret what they need to publish in different ways." Such inconsistency, she adds, is "a real problem for organizations trying to build sustainable businesses."<sup>104</sup> The problem is particularly acute for SMEs that attempt to extract value from (and build businesses around) aggregation or linked data—technical incompatibility can make such efforts all but impossible.

**3. Challenges Analyzing Data:** While SMEs are uniquely positioned to benefit from open data, they also suffer some of the same difficulties that restrict their access to big data in general. Large data sets (whether structured or not) often require sophisticated analytical tools and capacities in order to yield meaning or insights. Those tools can require resources that are not generally available to small businesses and start-ups. The problem is not just financial (though SMEs are of course more financially constrained than larger companies), but also one of human capital. McKinsey estimates, for example, that by 2018, the United States could face a shortage of up to "190,000 people with deep analytical skills as well as 1.5 million managers and analysts with the know-how to use the analysis of big data

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101 Mike Wheatley, "Open Data's Dirty Secret: Poor Quality and Potential for Abuse." *Silicon Angle*, October 2, 2014, "Is Open Data at Risk from Poor Data Quality?" DQ Global, <http://www.dqglobal.com/is-open-data-at-risk-from-poor-data-quality/>, accessed November 12, 2014.

102 Mike Wheatley, "Open Data's Dirty Secret: Poor Quality and Potential for Abuse." *Silicon Angle*, October 2, 2014, "Is Open Data at Risk from Poor Data Quality?" DQ Global, <http://www.dqglobal.com/is-open-data-at-risk-from-poor-data-quality/>, accessed November 12, 2014.

103 Amrita Khalid, "Google: Lack of Open Standards Hampers Information Sharing in Disasters," *The Hill*, June 4, 2013.

104 Joe Curtis, "Does Open Data Need to Be Released Fast or Carefully Curated?" *CBR Online*.

to make effective decisions.”<sup>105</sup> Such human resource constraints are likely to disproportionately affect SMEs and start-ups.

The problem is exacerbated by the poor quality of much open data. The previously mentioned study of “dirty data” in the UK concluded that the various errors and incompatibilities in the data meant that “systematic scrutiny would require advanced computer programming skills.”<sup>106</sup> Such requirements raise the possibility that, far from leveling the playing field, open data could in fact widen the gap between those companies with the resources to analyze data and those lacking such capacities.

**4. Challenges Monetizing Data:** Question 8 outlines some existing and emerging revenue models for SMEs considering using open data. Despite the existence of these models, however, it remains the early days for SMEs seeking to monetize open data. As with so much of the digital economy (and perhaps even more so in the case of open data), there is often a presumption that data should be free. For example, the consulting firm Gartner has estimated that, by 2016, only a third of companies will have found ways to monetize their data assets.<sup>107</sup>

All of this increases the difficulty of building a viable business around open data. In order to succeed, open data SMEs will need to continuously innovate and experiment with various revenue models. In particular, they will need to develop models that rely less on data as a commodity (i.e., charging for raw data) and increasingly on value-added services and products that can be added “on top” of data. The “multisided” revenue models mentioned earlier are also critical: to extract the full value of data assets, companies must typically look beyond a single revenue stream or paying client, and instead combine different sources of payment.

**5. Privacy Challenges:** Concerns over what one observer calls “the moral entanglement of open data and privacy”<sup>108</sup> represent some of the most significant challenges to open data. Although the tension between openness and privacy is often exaggerated, there exists widespread—and often legitimate—concern among citizens about the perceived trade-offs. A recent survey on citizen attitudes to big data, conducted by WhiteHouse.gov, found for example that 75 percent of respondents worried about “data storage and security” and 80 percent had worries concerning “transparency about data use.”<sup>109</sup> Such misgivings are repeated across the world<sup>110</sup> and serve to lower public enthusiasm and support for open data initiatives.

A similar lack of trust can be found among data originators. A recent survey of civilian and military IT leaders found that 68 percent expressed concerns over “data sensitivity” and 61.1% over “privacy”; the survey identified such concerns—along with poor data quality and others—as the “chief challenges to more open data in government.”<sup>111</sup> Such anxieties are both a mirror of citizen concerns and fed by them. After all, when companies know that their clients fear open data, they are less likely to engage in open data initiatives. Concerns over privacy, and a lack of knowledge about the open data process,

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105 James Manyika, Michael Chui, Brad Brown, Jacques Bughin, Richard Dobbs, Charles Roxburgh, and Angela Hung Byers, “Big Data: The Next Frontier for Innovation, Competition, and Productivity,” McKinsey & Company, [http://www.mckinsey.com/insights/business\\_technology/big\\_data\\_the\\_next\\_frontier\\_for\\_innovation](http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation).

106 Mark Ballard, “Poor Data Quality Hindering Government Open Data Programme,” August 28, 2014.

107 The reference is to big data in general. The percentage might be even lower in the case of open data. Saroj Kar, “Gartner: 30% of Companies to Monetize Big Data Assets by 2016,” Cloud Times, January 16, 2013, <http://cloudtimes.org/2013/01/16/gartner-monetize-big-data-assets-2016/>.

108 Ben Rooney, “The Balance Between Open Data and Privacy,” Wall Street Journal, September 12, 2012, <http://online.wsj.com/articles/SB10000872396390443884104577647600306243684>.

109 “The 90-Day Review for Big Data,” The White House, <http://www.whitehouse.gov/issues/technology/big-data-review>, accessed November 12, 2014.

110 See, for instance, this survey conducted in Europe: [http://europa.eu/rapid/press-release\\_IP-11-742\\_en.htm?locale=en/](http://europa.eu/rapid/press-release_IP-11-742_en.htm?locale=en/). A notable distinction, however, between US and European citizens is that the former tend to distrust the government’s handling of data more than the private sector, while in Europe citizen concerns are reversed.

111 Frank Konkell, “Survey Identifies Old IT Culprits as Top Barriers to More Open Government,” NextGov, June 10, 2014, <http://www.nextgov.com/technology-news/2014/06/survey-identifies-old-it-culprits-top-barriers-more-open-government/86155/>.

can therefore be self-reinforcing in the ways they restrict data flows—consumers become skeptical of open data initiatives, and business owners may avoid open data because of these concerns.

Concerns over privacy are probably unavoidable—and even healthy—in an era of big data. But they need not stymie the potential of open data. Policy makers can greatly aid SMEs by establishing an enabling regulatory framework that helps protect privacy and ensure citizen trust. Companies can help themselves too by adhering to industry standard best practices (e.g., those published by TrustE) and ensuring the security of personal information. Technical solutions like anonymization and de-identification can also play an important role (with the caveat that we now know that ostensibly anonymized data sets have frequently been “re-identified”).<sup>112</sup> Overall, the effort to ensure privacy must be multipronged and at the core of any SME’s open data strategy; trust is in many ways the foundation upon which the open data economy will ultimately be built.

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112 Pete Warden, “Why You Can’t Really Anonymize Your Data,” *O’Reilly Radar*, May 17, 2011, <http://radar.oreilly.com/2011/05/anonymize-data-limits.html>; Steve Wildstrom, “How Real a Threat Is ‘De-Anonymization,’” *Steve Wildstrom on Tech*, May 31, 2011, <http://swildstrom.wordpress.com/2011/05/31/how-real-a-threat-is-de-anonymization/>.

## SUMMARY: OPEN DATA, VALUE CREATION, AND SMES

<b>Types of open and shared data being used by SMEs</b> Government data Science data Corporate data	<b>Types of Products</b> Analysis, Insight, and Decisionmaking Support Data Interfaces and Visualization Platforms Consulting Services Data-driven Products Software, Web, and Mobile Application Development and Services Educational Services and Materials
<b>Main Sectors</b> Technology Finance and Investment Business and Legal Services Health Care	<b>Revenue Models</b> Subscription Advertising Fees for Products and Services Freemium Licensing Fees Razor and Blades Philanthropic Grants, Donations, and Sponsorships
<b>Market Segments</b> B2C B2B B2G Multiple Markets	<b>Evaluating Impact</b> Direct value of open data to SMEs The indirect value of open data to third-party organizations doing business with open data SMEs The indirect value of open data to consumers using open data SMEs The wider societal impacts that can be attributed to open data SMEs
<b>Four steps to add value to open and shared data</b> Consolidating and Organizing Cleaning and Standardizing Augmenting through Linking and Aggregating Data Analysis	<b>Challenges</b> Challenges Collecting Data Challenges Processing or Synthesizing Data Challenges Analyzing Data Challenges Monetizing Data Privacy Challenges



IV

# Ten Principles for Effective Use of Open Data for SMEs



The preceding discussion, based on extensive research and real-world case studies, helps us identify ten principles for any SME considering using open or shared data. Needless to say, these principles are not universally applicable. Moreover, in a rapidly changing landscape of technological innovation, new principles will certainly emerge, and some of those we outline here may become obsolete. This suggests the need for further—and ongoing—research. In the meantime, the following principles offer a preliminary road map for SMEs and start-ups seeking to develop an open data strategy.

**1. Define the problem and how open data can solve it.** We have seen that open data is used in a variety of contexts and for a number of different purposes. If an SME is considering an open data strategy, it is essential to define its terms of engagement with open data up front. In particular, the SME should identify the problem it is trying to solve, and then determine whether the solution lies in developing a new product or service, or optimizing existing ones. Other important decisions involve choosing market segments and appropriate revenue models.

**2. Conduct a data audit.** Open data comes in many shapes and forms. It is also available from many sources, and in varying degrees of quality. Before deploying open data, SMEs should conduct a data audit to understand what resources—internal and external—are available that can help solve the problem identified, and what the costs (financial or otherwise) would be in order to use those resources.

**3. Learn from others.** Case studies of the kind we have used to build this report provide valuable lessons and insight. They can help SMEs better understand the opportunities and challenges of the open data landscape, and they ground lessons and principles in proven strategies. In a rapidly evolving field with few ironclad rules or proven strategies, such real-world examples offer one of the best pathways to success.

**4. Do a risk assessment.** Although it is easy to get seduced by the buzz and newness of open data, SMEs should also carefully consider some of the associated risks and challenges (see Question 10, above). Access to data, data quality, and the human and capital costs of data need to be taken into account. In addition, SMEs also need to develop a comprehensive privacy plan before any attempt to use personally identifiable information. More generally, careful strategic consideration needs to be given to the risks of entering such a nascent field, where many of the most important business parameters—product and marketing strategies, revenue models—remain at best works in progress.

**5. Do a cost-benefit analysis** before integrating open and shared data. This is an essential step, whether you are considering a new open data program or expanding an existing one. The preceding discussion can help define some of the most important parameters and variables to consider in such a cost-benefit analysis.

**6. Experiment and innovate.** Using open data successfully requires agility and the ability to experiment. Companies must be willing to think out of the box and “fail quickly.” As we have seen, successful business models (and products) are still unclear: the potential of open data is most likely to be fulfilled through an iterative process of trial-and-error.

**7. Determine metrics of success.** Successful trial and error relies on metrics to determine whether an experiment has succeeded or failed. Metrics can also help quantify the value added to SMEs by an open data initiative. Question 9, above, outlines some pathways to developing metrics to capture the effects of open data.

**8. Invest in data literacy** within SMEs. Data proficiency is one of the key determinants of success when it comes to open data. Understand the qualifications and gaps when it comes to SMEs’ ability to collect, store, process, and analyze data.

**9. Monitor or set up a monitoring system** to alert SMEs to new and relevant open and shared data sources. New data sets are being released by government agencies, researchers, and corporations on a regular basis. Stay connected with the open data community, and set up alerts to stay abreast of any developments that may benefit your business.



**10. Give back to the open data community.** As the preceding discussion makes clear, open data is an ecosystem: it consists of a web of mutually dependent companies (some of which may also be competitors), government entities, and other organizations. The importance of data linkages and data aggregation in particular highlights the need for collaboration and cooperation within the ecosystem. Open data is not, in short, a zero-sum game; even while seeking to maximize an SME's advantage, it should also have a program in place to identify data sets it can share with others, and to strengthen partnerships with public entities and other SMEs.

# Appendix I: Open Data Definitions

## 1. Open Definition

(referenced by *Open Data Handbook*, ODI, Open Data Census, and OECD Open Data Analytical Framework)<sup>113</sup>

“Open data is data that can be freely used, reused and redistributed by anyone—subject only, at most to the requirement to attribute and share-alike.”

## 2. The White House, 2013 OMB Memorandum<sup>114</sup>

“Open data refers to publicly available data structured in a way that enables the data to be fully discoverable and usable by end users.”

## 3. Data.Gov.UK<sup>115</sup>

“Open data is data that is published in an open format, is machine readable and is published under a license that allows for free reuse.”

## 4. DBpedia: A Nucleus for a Web of Open Data<sup>116</sup>

“Open data is the idea that certain data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control.”

## 5. Open Data Institute<sup>117</sup>

“Open data is information that is available for anyone to use, for any purpose, at no cost. Open data has to have a license that says it is open data. Without a license, the data cannot be reused. These principles for open data are described in detail in the Open Definition.”

## 6. LinkedGov<sup>118</sup>

“Open data is nonpersonally identifiable data produced in the course of an organization’s ordinary business, which has been released under an unrestricted license. Open public data is underpinned by the philosophy that data generated or

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113 “Open Definition,” Open Knowledge Foundation, <http://opendefinition.org/od>, accessed February 23, 2014.

114 Sylvia Burwell et al., “Memorandum for the Heads of Executive Departments and Agencies,” *Open Data Policy—Managing Information as an Asset*, May 9, 2009, <http://www.whitehouse.gov/the-press-office/memorandum-heads-executive-departments-and-agencies-3-9-09>.

115 “A Simple Intro to Open Data,” Data.Gov.UK, April 11, 2013, <http://data.gov.uk/blog/simple-intro-open-data>, accessed February 23, 2014.

116 Auer Sören, Christian Bizer, Georgi Kobilarov, Jens Lehmann, Richard Cyganiak, and Zachary Ives. “DBpedia: A Nucleus for a Web of Open Data,” *Lecture Notes in Computer Science* 4825 (2007): 722–735.

117 “Guides: What Is Open Data?,” Open Data Institute, accessed February 23, 2014, <http://theodi.org/guides/what-open-data>.

118 “What Is Open data?,” LinkedGov, <http://linkedgov.org/what-is-open-data>, accessed February 23, 2014.

collected by organizations in the public sector should belong to the taxpayers, wherever financially feasible and where releasing it will not violate any laws or rights to privacy (either for citizens or government staff).”

## 7. McKinsey Global Institute<sup>119</sup>

“Machine-readable information, particularly government data, that’s made available to others. These open data sets share the following 4 characteristics:

**Accessibility:** A wide range of users is permitted to access the data.

**Machine readability:** The data can be processed automatically.

**Cost:** Data can be accessed free or at negligible cost.

**Rights:** Limitations on the use, transformation, and distribution of data are minimal.”

## 8. Open Data Now<sup>120</sup>

“Open Data is accessible public data that people, companies, and organizations can use to launch new ventures, analyze patterns and trends, make data-driven decisions and solve complex problems.”

## 9. Open Data Barometer<sup>121</sup>

Excerpt from report indicates that researchers assessed data sets based on the “full Open Definition requirements of being machine readable, accessible in bulk, and openly licensed.”

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119 James Manyika, Michael Chui, Diana Farrell, Steve Van Kuiken, Peter Groves, and Elizabeth Almasi Doshi, “Open Data: Unlocking Innovation and Performance with Liquid Innovation,” McKinsey Global Institute, November 1213.

120 Joel Gurin, *Open Data Now* (New York: McGraw Hill Education, 2014).

121 Tim Davies, “Open Data Barometer: 2013 Global Report,” *Open Data Research*, October 31, 2013.

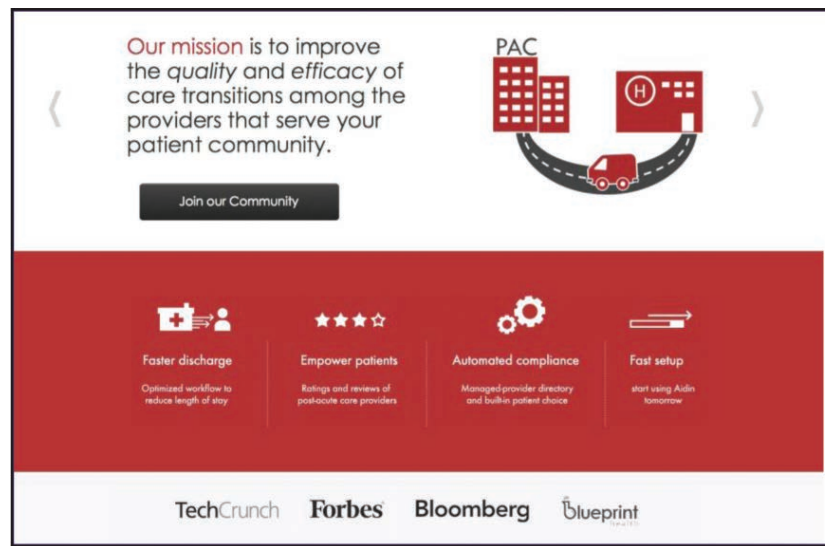
# Appendix II: Table of Open Data Definitions

Author Organization	LEGAL CONDITIONS										The GovLab <i>Proposed Working Definition</i>
	Open Knowledge Foundation <i>Open Definition</i>	The White House - Sylvia Burwell et al. <i>OMB Memo, 2013</i>	Antonio Acuña <i>Data.Gov.UK</i>	Auer Sören et al. <i>"DBpedia: A Nucleus for a Web of Open Data"</i>	Open Data Institute (ODI)	LinkedGov	James Manyika et al. <i>McKinsey</i>	Joel Gurin <i>Open Data Now</i>	Tim Davies <i>Open Data Barometer</i>	The World Bank	
	Requires "open" license that protects selected criteria			✓		✓				✓	
	Re-use and redistribution	✓		✓	✓	✓				✓	
No restrictions from copyright, patents, etc.											
FINANCIAL CONDITIONS											
Free or negligible cost	✓	✓		✓	✓		✓				
Belongs to the taxpayer											
TECHNICAL CONDITIONS											
Structured for usability (i.e., standardized and machine readable)		✓	✓						✓	✓	✓
Accessible in bulk									✓		
De-identified											✓

## Appendix III: Selected In-Depth Case Studies

These are the eight initial case studies that provided the groundwork for the framework that was used to analyze 100+ of the SMEs included within the Open Data 500 project.

### III.1 AIDIN | *MyAidin.com*



**Value Proposition:** Founded in 2011, Aidin is a health care referral management system created specifically for discharge-planning professionals with the aim of simplifying the existing complex discharge system in hospitals and clinics in the United States. Following a negative experience organizing the post-discharge care of a family member suffering from a chronic disease, the Aidin family developed this service to help health-care professionals and patient families organize and contact available post-acute care providers that deal with specific health conditions after a patient’s hospital discharge in the United States.<sup>122</sup> Selected as one of Blueprint Health’s and New York Digital Health Accelerator’s first classes of innovators in 2012, the company has been labeled the “Yelp for continuing care.”<sup>123</sup>

**Open and Shared Data:** Aidin uses Medicare data collected by the Department of Health and Human Services. In particular, it uses data sets from Home Health Compare, a database containing information about the quality of care provided by Medicare-certified home agencies, and Nursing Home Compare, a database including a number of different data sets of inspection results and audits, demographic information, and quality-of-care measures.<sup>124</sup> Both databases contain a variety of different data sets, and are updated regularly. For instance, Nursing Home Compare is updated monthly, demographic data is refreshed monthly, and quality measures are refreshed once each quarter.

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<sup>122</sup> “Our Story,” Aidin, <http://www.myaidin.com/ourstory.html>, accessed November 12, 2014.

<sup>123</sup> Rip Empson, “Meet the Three Most Fundable Health Companies from the DC to VC Showcase,” *TechCrunch*, October 12, 2012.

<sup>124</sup> “Aidin,” *OpenData500 GovLab*.

**Adding Value to Open and Shared Data:** Because the sheer variety of data can act as a barrier to public access, Aidin provides a valuable service by integrating the different data sets and offering them in a unified, searchable interface. Whereas data on post-acute health agencies is otherwise difficult to find and comprehend online, Aidin provides the information in an actionable, simplified format. The company also categorizes this information, places it in a searchable format, and enables its output into a one-page, readable document to be given to patients at discharge.

**Sector and Market Segment:** Aidin is located in the health-care sector and serves both the B2B and B2C markets. Aidin products are intended for three different user groups: (1) discharge health-care professionals at hospitals and inpatient care facilities; (2) patients; and (3) post-acute care providers, such as nursing homes, physiotherapists, or other outpatient providers.

**Products and Revenue Model:** Aidin licenses its software to hospitals, and post-acute care providers. The Aidin Product Suite separates user groups into two different products (with patients being common to both). Aidin Lite is used by hospitals with e-discharge systems, to find and choose post-acute care providers suitable for the patient's needs and automate Medicare compliance. Another service, Aidin Provider, is geared towards post-acute care providers, and is used to keep track of referrals and patient reviews. Open data is used as part of the databases to evaluate post-acute care providers; however, users can add data in the form of referrals as well. The company typically charges \$3,000 to \$6,000 a month for a subscription to its services.

**Measuring Impact:** Aidin's product would not be possible without access to HHS data. Though it is still a small company, reporting in 2014 that it had four full-time employees, evidence suggests that Aidin has already had direct impact on the experience of patients and hospital staff. On the hospital health-care provider side, Aidin saves discharge planning staff "an average of 45–60 minutes per discharge and improves the quality of care patients receive in the post-acute setting, improving HCAHPS scores and reducing readmissions."<sup>125</sup> The company typically charges hospitals between \$3,000 to \$6,000 a month for a subscription to its services, but hospitals that use Aidin are, on average, expected to save approximately \$145,000 a year.<sup>126</sup> Additionally, hospitals that used Aidin in pilot studies saw their readmission rates drop between 3 and 17 percent.<sup>127</sup>

Reducing the readmission rates has an important impact on hospitals. According to the company, one in four Medicare patients are readmitted into hospitals within 30 days, and the financial impact of preventable readmissions is estimated at \$17 billion every year.<sup>128</sup> One of the major reasons readmissions are so high in the United States is because data quality and availability on post-acute care facilities—nursing homes, health agencies, and rehabilitation centers—have typically been poor.

Aidin's tools therefore go a significant way toward increasing the accessibility and usability of patient data, in the process improving the quality of post-discharge care, creating financial efficiencies, and empowering patients to take control and make more informed choices regarding their care. The company is also improving direct communication between patients and providers, further enhancing patient control and transparency in the process. The company uses open health-care data to empower patients and families and to serve hospitals by helping them connect their patients with better care so that there are fewer readmissions and expenses. Finally, Aidin enables nursing homes and home health agencies to share information about themselves with patients in a direct manner.

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<sup>125</sup> "Products," Aidin, <http://www.myaidin.com/learnmore.html>, accessed November 12, 2014.

<sup>126</sup> <http://www.slideshare.net/HealthDataConsortium/health-datapalooza-2013-aidin>.

<sup>127</sup> Stacey Higginbotham, "Aidin Gets \$1.1M to Make Moving from a Hospital to Nursing Home Easier," May 16, 2014.

<sup>128</sup> Rip Empson, "Aidin Finds \$600K from General Catalyst & More for a Yelp for Continuing Care," TechCrunch, June 15, 2012.

### III.2 AZAVEA | *Azavea.com*



**Value Proposition:** Azavea is a certified B corporation with a mission to use geospatial technologies to create positive civic and social impact and state-of-the-art research.<sup>129</sup> The company was founded by Robert Cheetham, a former software developer and analyst for the Philadelphia Police Department, the University of Pennsylvania, and the City of Philadelphia.<sup>130</sup> The company specializes in the creation of geographic web and mobile software, and geospatial analysis, to enable the public to enable and access data. Its mission is “to apply geospatial technology for positive civic and social impact while advancing state-of-the-art geospatial analysis through research.”<sup>131</sup> Founded in 2000, the company specializes in the creation of geographic web and mobile software, as well as geospatial analysis services.<sup>132</sup>

**Open and Shared Data:** The company leverages open government geospatial data from over a hundred federal, state, and local sources in its product solutions and is dedicated to making that data available to others through creative new applications.<sup>133</sup> Working with both proprietary and open source software, Azavea is an authorized partner of Esri as well as CartoDB.<sup>134</sup> Azavea uses open geospatial data from over 100 open government sources, including the National Oceanic and Atmospheric Administration, the National Weather Service, the US Census Bureau, the US Geological Survey, the Department of Energy, and the US Environmental Protection Agency. The company also culls data from State and local repositories, as well as the Federal Bureau of Investigation for certain projects.

**Adding Value to Open and Shared Data:** Azavea takes data that is flat and inscrutable, layers and combines it, and presents an output in the form of lively, geospatial maps that make trends starkly visible and solutions obvious.

**Sector and Market Segment:** Azavea is in the Geospatial/Mapping sector, but creates software and platforms that have application across numerous industries, with clients in the nonprofit, academic, and government sectors. Azavea has sought to apply its technical expertise in geospatial research and analysis across a wide array of domains spanning natural

129 Robert Cheetham, “Driving Innovation with Research and Online Courses,” *Directions Magazine*, June 12, 2014, <http://www.directionsmag.com/articles/driving-inno-vation-with-research-and-online-courses/403598>.

130 “Staff Profiles: Robert Cheetham, President/CEO,” Azavea, <http://www.azavea.com/about-us/staff-profiles/robert-cheetham/>.

131 “Azavea,” *OpenData500 GovLab*, <http://www.opendata500.com/Azavea/>, accessed November 12, 2014.

132 Azavea, <http://www.azavea.com/>, accessed November 12, 2014.

133 “Azavea,” *OpenData500 GovLab*.

134 “Our Partners,” Azavea, <http://www.azavea.com/services/our-partners/>, accessed November 12, 2014.



resource planning, neighborhood revitalization, economic development, crime analysis, real estate property analysis, redistricting, political advocacy, and cultural resources management.<sup>135</sup> Government clients include the City of Philadelphia, the National Science Foundation, and the US Army Corps of Engineers. Business such as Gannet Corporation and the *Washington Post* are also clients. Nonprofit organizations include the Avenue of the Arts and Committee of Seventy. The company has also completed projects for MIT and Penn State, among others.

**Products and Revenue Model:** The products and services provided by the firm include combinations of research and development, spatial analysis and mapping, spatial data mining, modeling and distributed computing, systems integration, strategic planning and architecture design, and web and mobile application development.<sup>136</sup> The company provides a number of customized data management and analytics solutions that vary in complexity. According to Azavea, the three best examples of the company's custom work are (1) Sajara, web-based geographic digital asset management software that enables users to geographically display, retrieve, and manage digital media on Google Maps or Google Earth,<sup>137</sup> (2) HunchLab, a crime prediction software that uses advanced machine-learning algorithms to fuse crime theories and data sets for precise evidence-based forecasts of when and where crimes are likely to emerge,<sup>138</sup> and (3) Azavea's Kaleidocade Indicator Framework (KIF), a comprehensive interface, integrated with the Esri ArcGIS platform, to visualize, compare, and analyze data aggregated at different geographic levels in one single web-based system.<sup>139</sup> All three of these projects enable the vertical integration and aggregation of multiple layers of data from a variety of sources, including the Departments of Commerce, Justice, and Energy, for geospatial and temporal visualization and analysis.

Additionally, the company has created a number of open source solutions for the public. First established in Philadelphia, Azavea is the original developer of the OpenDataPhilly.org community site and remains active as the city's Open Data Institute (ODI) regional node. The company also created a number of open source tools, libraries, and utilities—sharing much of its work by releasing it under open source licenses so that others may reuse it, such as GeoTrellis,<sup>140</sup> a geographic data processing engine for high performance applications,<sup>141</sup> DistrictBuilder, a web-based collaborative, customizable tool for transparent redistricting,<sup>142</sup> and OpenTreeMap, a collaborative platform for crowdsourced tree inventory, ecosystem services calculations, urban forestry analysis, and community engagement.<sup>143</sup>

**Measuring Impact:** Due to its close collaboration with government agencies, Azavea's business strategy relies upon access to open government data, which has a direct impact on Azavea's operations. The company is quickly growing, reporting 35 employees in 2014, and \$2.2 million in sales in 2013. Azavea's projects have an indirect value to client organizations, providing clients in the private, public, and nonprofit sectors with an improved understanding and ability to leverage geospatial and other data toward a variety of objectives. This impact then travels to citizens, who can use applications like Cicero, an app and API that provides users with the ability to match their address to legislative district and elected official contact information.<sup>144</sup>

Azavea runs as "a for-profit business with a nonprofit social mission."<sup>145</sup> The company combines its technological geospatial expertise to "harness the power of geography"<sup>146</sup> and contribute to a broad foundation upon which government,

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135 "About Us," Azavea, <http://www.azavea.com/about-us/>, accessed November 12, 2014.

136 "Services," Azavea, <http://www.azavea.com/services/>, accessed November 12, 2014.

137 "Sajara," Azavea, <http://sajara.azavea.com/>, accessed November 12, 2014.

138 HunchLab, <http://www.hunchlab.com/>, accessed November 12, 2014.

139 "Kaleidocade," Azavea, <http://www.azavea.com/products/kaleidocade/>, accessed November 12, 2014.

140 "Software Projects," Azavea, <http://www.azavea.com/research/azavea-commons/#software-projects>, accessed November 12, 2014.

141 "What Is Geotrellis?," GeoTrellis, <http://geotrellis.io/introduction/what-is-geotrellis/>, accessed November 12, 2014.

142 "District Builder," Azavea, <http://www.azavea.com/products/districtbuilder/>, accessed November 12, 2014.

143 OpenTreeMap, <https://www.opentreemap.org/>, accessed November 12, 2014.

144 "Cicero," Azavea, <http://www.azavea.com/products/cicero/>, accessed November 12, 2014.

145 Art Carey, "The Father of Invention," *AxisPhilly*, February 3, 2014, <http://axisphilly.org/article/the-father-of-invention/>.

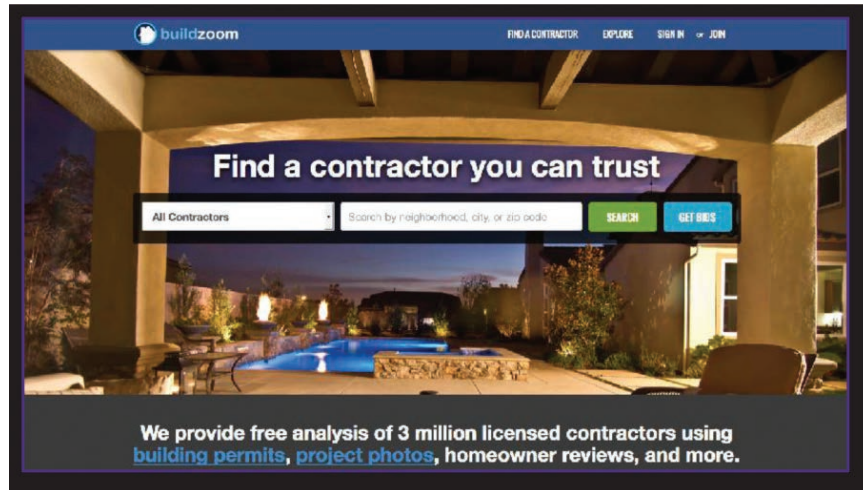
146 "Products," Azavea, <http://www.azavea.com/products/>, accessed November 12, 2014.



private organizations, and nonprofits operate by exchanging information and fostering collaboration for the common good across a wide variety of sectors.

Across the board, the company has been recognized as providing useful, impactful services to governments, nonprofits, and private companies alike. The company has received over two dozen awards ranging from Business Partner of the Year and Fastest-Growing Inner City Companies Awards, to federal grants for its products and research and Innovation Awards for specific client projects.<sup>147</sup>

### III.3 BUILDZOOM | *BuildZoom.com*



**Value Proposition:** BuildZoom is an online resource designed to help homeowners find information about contractors for home remodeling or other construction projects.<sup>148</sup> Founded in 2010 in San Francisco, the company uses public and private databases, in conjunction with crowdsourced data, to collect and share information about contractors and construction businesses in order to help individuals make more informed decisions about which contractors to hire. The size of the home contracting market is estimated at \$500 billion annually,<sup>149</sup> but the market is fragmented and lacks transparency.

Although a wide variety of data on contractors does exist at the state and federal levels, much of this information is hard to access and lacks standardization. Homebuilders and home renovators are forced to make important (and often expensive) decisions based on subjective, word-of-mouth recommendations.

**Open and Shared Data:** BuildZoom uses a combination of data from public and private databases, as well as crowdsourced reviews from users on its own site. As of 2013, BuildZoom's database included every licensed contractor—over 2.5 million—in the United States.<sup>150</sup> To collect this information, the company assembled permit records from over 100 regulatory agencies across the United States, at federal, state, and city levels.<sup>151</sup> BuildZoom also supplements contractor

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147 "Awards," Azavea, <http://www.azavea.com/about-us/awards/>, accessed November 12, 2014.

148 Ken Yeung, "Here Are Our Six Favorite Startups from the First Batch of Y Combinator's Winter 2013 Demo Day," *The Next Web*, March 26, 2013, <http://thenextweb.com/insider/2013/03/26/here-are-our-six-favorite-startups-from-the-first-batch-of-y-combinators-winter-2013-demo-day/>.

149 Rebecca Grant, "BuildZoom Uses Big Data to Prevent Home Renovation Nightmares (Exclusive)," *VentureBeat*, September 12, 2013, <http://venturebeat.com/2013/09/12/buildzoom-us-es-big-data-to-prevent-home-renovation-nightmares-exclusive/>.

150 Sarah Perez, "BuildZoom Connects Homeowners with Contractors for Remodeling Projects, Doesn't Charge for Access or Leads," *TechCrunch*, March 14, 2013, <http://techcrunch.com/2013/03/14/buildzoom-connects-homeowners-with-contractors-for-remodeling-projects-doesnt-charge-for-access-or-leads/>.

151 Rebecca Grant, "BuildZoom Uses Big Data to Prevent Home Renovation Nightmares (Exclusive)," *VentureBeat*, September 12, 2013, <http://venturebeat.com/2013/09/12/buildzoom-us-es-big-data-to-prevent-home-renovation-nightmares-exclusive/>.

profiles with information from the Better Business Bureau (BBB). This information is sourced from individual BBBs across the country and has sometimes posed a challenge for the company.<sup>152</sup> Additionally, users provide their own data to the site in the form of customer and peer reviews, and contractors can add information to their profiles including sample images of work (currently there are photos of over 100,000 construction and remodeling projects on the site).<sup>153</sup>

**Adding Value to Open and Shared Data:** One major attraction of BuildZoom lies in its capacity to combine data from across a variety of data types and sources. To aggregate data from these different sources effectively, BuildZoom must standardize and organize the information in a way that increases its usability and accessibility. For instance BuildZoom has gathered, collated, and tagged information from each of 114 regional Better Business Bureau chapters across the country.<sup>154</sup> Using this data, in conjunction with other public and crowdsourced data available, BuildZoom assigns contractors a score, arriving at a data-driven inference to make a recommendation on which contractors to hire for a remodeling or construction project. BuildZoom has also leveraged government data on building permits as a way for users to identify home improvement, remodeling, and construction trends in their area. In addition, BuildZoom recently launched a dashboard (in beta) to enable users to visualize macro-economic trends in the construction industry through an analysis of data such as number of permits issued in a given region or time period.

**Sector and Market Segment:** BuildZoom operates in the Housing/Real Estate sector and targets products on both a B2B and B2C basis. BuildZoom is intended to be used primarily by two user groups, each for different purposes: (1) homeowners, to find a contractor for projects; and (2) contractors, to promote their businesses.<sup>155</sup>

**Products and Revenue Model:** BuildZoom functions as a data-driven decision-making support platform and rating and review website for home renovation. Currently, both user groups can sign up for free on the site. TechCrunch reported in 2013 that the company plans to monetize by offering services to the contractors themselves, providing opportunities for paid advertisements, and by designing websites for its contractor customers.<sup>156</sup> Using the site, homeowners can find out whether contractors are licensed; the class of license they hold; the year they were licensed; whether their license has ever been suspended; whether the contractor has ever had a complaint filed against him or her; and whether the contractor is bonded or insured. Contractors can use the site to add to their profile, increasing their appeal to potential customers. Once a homeowner decides to hire a contractor, BuildZoom provides a bidding system that allows users to confidentially receive three competitive quotes.<sup>157</sup>

**Measuring Impact:** Like so many companies built around open data, BuildZoom's success derives not primarily from generating new information or data, but by innovating around existing information.

However, though open and shared data has played a large role in BuildZoom's operations, the company's use of crowdsourced data for ratings and reviews of contractors, as well as data provided by businesses that contribute to their own profile pages, suggests that open and shared data plays a crucial, though not exclusive, role in BuildZoom's data-driven business strategy.

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152 Sarah Perez, "BuildZoom Connects Homeowners with Contractors for Remodeling Projects, Doesn't Charge for Access or Leads," TechCrunch, March 14, 2013.

153 BuildZoom, [http://www.buildzoom.com/user/sign\\_up](http://www.buildzoom.com/user/sign_up), accessed November 12, 2014.

154 "BBB Directory," Council of Better Business Bureaus, <http://www.bbb.org/bbb-directory/>, accessed November 12, 2014.

155 BuildZoom, [http://www.buildzoom.com/user/sign\\_up](http://www.buildzoom.com/user/sign_up), accessed November 12, 2014.

156 Sarah Perez, "BuildZoom Connects Homeowners with Contractors for Remodeling Projects, Doesn't Charge for Access or Leads," TechCrunch, March 14, 2013.

157 "Contractors in the US," BuildZoom, <http://www.buildzoom.com/find/contractors>, accessed November 12, 2014.

Though the company is still small (in 2014 reporting 12 full-time employees), it is growing. Co-founder David Peterson reported that the site currently serves more than 640,000 unique users each month.<sup>158</sup> The company continues to expand rapidly (every week, an estimated 1500 contractors sign up for its services),<sup>159</sup> and is a good example of a business that has grown by introducing efficiencies and greater transparency into information flows. Investors seem to be confident in BuildZoom's model—in 2014 the company announced that it raised \$2.15 million in Series Seed funding.<sup>160</sup>

BuildZoom's impact can be felt across its user bases and their local economies, through providing contractors with the ability to supplement a public-facing profile and track trends in the field, and through helping consumers make better informed decisions regarding contracting and home remodeling work—a notoriously difficult and distributed industry.

### III.4 CALCBENCH | *CalcBench.com*



**Value Proposition:** Founded in 2011, Calcbench is a free interactive data platform that enables the access and analysis of financial data provided through the Securities and Exchange Commission (SEC). The company emerged out of an app design challenge hosted by the team behind XBRL (eXtensible Business Reporting Language), the interactive data reporting standard required since 2010 by the SEC for almost all publicly listed businesses in the United States.<sup>161</sup> Calcbench's goal is to increase the accuracy, accessibility, and quality of data available through the SEC. Since 2010, the SEC has standardized electronic financial filing into the XBRL format to make financial data more readily accessible, readable, and usable.<sup>162</sup>

**Open and Shared Data:** Calcbench relies on XBRL data submitted by companies to the SEC. Today over 9,800 companies in the US have submitted their data to the SEC in XBRL format, generating 90,000 exhibits with 63 million data points in

158 "BuildZoom raises \$2.15 Million in Funding from Formation 8 to Make Remodeling and Construction a More Pleasant and Predictable Experience," Nasdaq: Global-Newswire, October 6, 2014, <http://globenewswire.com/news-release/2014/10/06/671024/10101472/en/BuildZoom-raises-2-15-Million-in-Funding-from-Formation-8-to-Make-Remodeling-and-Construction-a-More-Pleasant-and-Predictable-Experience.html>.

159 Rebecca Grant, "BuildZoom Uses Big Data to Prevent Home Renovation Nightmares (Exclusive)," September 12, 2013, <http://venturebeat.com/2013/09/12/buildzoom-uses-big-data-to-prevent-home-renovation-nightmares-exclusive/>.

160 "BuildZoom raises \$2.15 Million in Funding from Formation 8 to Make Remodeling and Construction a More Pleasant and Predictable Experience," Nasdaq: Global-Newswire, October 6, 2014, <http://globenewswire.com/news-release/2014/10/06/671024/10101472/en/BuildZoom-raises-2-15-Million-in-Funding-from-Formation-8-to-Make-Remodeling-and-Construction-a-More-Pleasant-and-Predictable-Experience.html>.

161 "XBRL.sec.gov," United States Securities and Exchange Commission, <http://xbrl.sec.gov/>, accessed November 12, 2014.

162 XBRL has become the global standard for the exchange of business information. However, because quality and consistency often remains an issue for XBRL data, ostensibly "open" XBRL data is often in fact inaccessible. Though XBRL data is available on the Electronic Data Gathering Analysis and Retrieval system (EDGAR) through the SEC, it is typically only available as raw files or in a viewer where users see a standard presentation that is not necessarily suited to the user's specific needs. Acknowledging the need for better analytical tools to parse and aggregate the data, the XBRL US, the US branch of the nonprofit, international standards organization that developed and maintained the XBRL specification, sponsored an annual challenge to encourage the development of more open-source analytical tools.

XBRL.<sup>163</sup> These data sets are available through the SEC, structured in machine-readable format to members and subscribers. Calcbench in effect makes the XBRL data actually open. Using the free version of the service, users can gain access to over 9,000 company reports without having to subscribe or become a member of XBRL US.<sup>164</sup> The data sets held by Calcbench include information on income statements, balance sheets, cash flow, profitability, liquidity, and solvency ratios, as well as other financials.

**Adding Value to Open and Shared Data:** Though financial data is increasingly accessible, widespread quality issues, such as lack of data completeness or consistency, have remained a challenge. Calcbench attempts to rectify data incompleteness, for example, by making adjustments for common errors such as period-to-period inconsistencies. Calcbench also aggregates complex financial data such as earning statements, cash flow statements, and balance sheets into a readable format. It does so using “proprietary artificial intelligence tools that sift through the data to detect errors such as misdated year-end reports.”<sup>165</sup> Finance professionals can then use the reformatted data to compare financial information across companies, for example, to examine industry-wide trends.

**Sector and Market Segment:** Calcbench operates in the finance and investment sector, and markets its products primarily to other businesses, though it also provides products to other market segments as well, such as academia. Billed as a tool for finance professionals, Calcbench identifies four sets of user groups that may benefit from its services: (1) corporations, (2) auditors, (3) investment researchers, and (4) academics.

**Products and Revenue Model:** Calcbench develops tools specifically designed for each user group’s individual needs. For instance, for “corporate reporting,” CalcBench provides information about improving reporting practices using XBRL and examining financial statements of other companies.<sup>166</sup> For “academics,” Calcbench makes available other tools to aid in “research and classroom instruction,” such as their Benchmarking and Analysis tool, or tools that can aid in research.<sup>167</sup> Calcbench’s tools reconfigure the data it pulls from the SEC for a variety of different activities and needs.

Among its numerous possibilities, XBRL data can be used to identify trends, benchmark against peer groups, conduct risk assessments, improve audit planning and risk analysis, and collect, analyze, and interpret financial data for investment purposes.<sup>168</sup> Calcbench’s tools also allow users to benchmark according to sector and query data according to a number of different criteria in the categories of “income statement,” “balance sheet” and “cash flow.”<sup>169</sup> In addition, the company offers APIs and other services to allow third parties to benefit from and innovate using its data tools.

Though it advertises itself as a “free collaborative platform for retrieving and working with financial data,” Calcbench in fact operates with a “freemium” revenue model. While certain products (e.g., company in detail, and the XBRL Filer Information Portal) are available without charge, others (benchmarking and analysis, bulk data query, footnotes query, and advanced company in detail) are provided for a cost as part of a Premium Suite.<sup>170</sup>

**Measuring Impact:** Calcbench’s business emerged out of the existence of XBRL data. The opening of financial data therefore had a direct impact on Calcbench’s business strategy. Serving the business-to-business market, Calcbench also provides indirect value to its client organizations, through creating a “direct line” into the SEC’s corporate financial data repository, in order to improve the quality and accessibility of their own XBRL data. The company also affects individual

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163 Eric E. Cohen, “Who’s Min(d)ing Your XBRL Data?,” *New Jersey Society of Certified Public Accountants*, May 1, 2014.

164 Eric E. Cohen, “Who’s Min(d)ing Your XBRL Data?,” *New Jersey Society of Certified Public Accountants*, May 1, 2014.

165 Cindy Waxer, “Government Open Data Proves a Treasure Trove for Savvy Businesses,” *Computer World*, March 24, 2014, [http://www.computerworld.com/s/article/9246970/Government\\_open\\_data\\_proves\\_a\\_treasure\\_trove\\_for\\_savvy\\_businesses?taxonomyId=9&pageNumber=4](http://www.computerworld.com/s/article/9246970/Government_open_data_proves_a_treasure_trove_for_savvy_businesses?taxonomyId=9&pageNumber=4).

166 “Corporate Reporting,” Calcbench, [http://www.calcbench.com/home/corporate\\_reporting](http://www.calcbench.com/home/corporate_reporting), accessed November 12, 2014.

167 “Educators and Students,” Calcbench, accessed November 12, 2014, [http://www.calcbench.com/home/educators\\_and\\_students](http://www.calcbench.com/home/educators_and_students).

168 Calcbench, <http://www.calcbench.com/>, accessed November 12, 2014.

169 “Query,” Calcbench, <http://www.calcbench.com/query>, accessed November 12, 2014.

170 “Pricing,” Calcbench, <http://www.calcbench.com/payment/pricing>, accessed November 12, 2014.

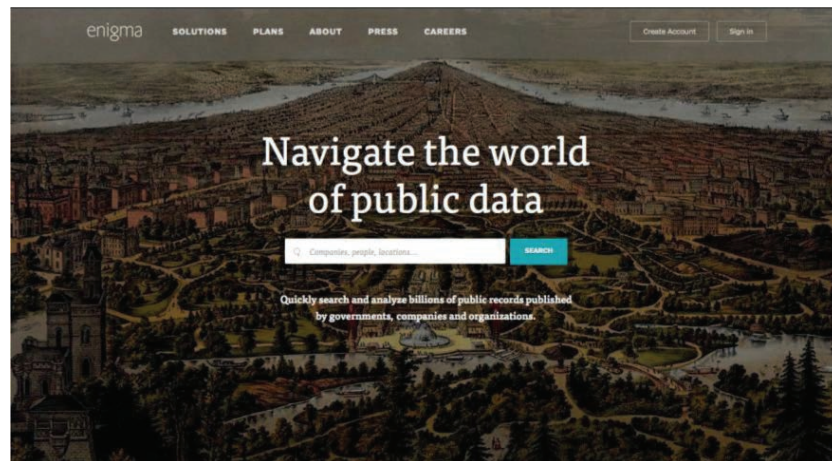
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consumers—using the free version, users can gain access to information that would otherwise only be available to XBRL US subscribers. Calcbench is therefore serving to “open” data that was previously only partially open to the public.

Calcbench’s tools work on improving the quality and consistency of data, and can yield better and more reliable insights into the financial standing of companies, as well as increase financial transparency and accountability. Additionally, the availability of comparative financial information can help companies understand their competition better and benchmark according to their peers.



### III.5 ENIGMA | *Enigma.io*



**Value Proposition:** Enigma is an analytics solution designed to help users access and analyze public data that has been made available by government agencies. CEO Jeremy Bronfman has stated that, in creating Enigma, the company sought to “create something like the Internet for public data that really made it easily accessible and digestible.”<sup>171</sup> The company secured \$1.1 million in seed funding in 2013, also winning TechCrunch Disrupt NY’s “hottest startup award” in that same year.

Enigma’s business model is based on a simple premise: although an increasing amount of data is being opened, it often remains inaccessible or difficult to make sense of. In addition, it is extremely difficult to make connections or enable “conversations” between different and often unstandardized public data sets. The goal of the company is to “harmonize and index” public data to enable new connections, conversations, and insights.<sup>172</sup> In the words of its co-founder, Marc DaCosta, the company hopes to become “a Google for public data.”<sup>173</sup>

**Open and Shared Data:** Enigma offers over 100,000 data sets from government agencies, companies, and organizations around the world. It includes data on government contracts, lobbying activity, sales tax receipts, financial filings, spectrum licenses, aircraft ownership, and import bills of lading from the United States Customs Department.

**Adding Value to Open and Shared Data:** Although all of the data Enigma uses is theoretically “open,” Enigma’s aim is to make it more accessible and usable. For example, the company “scrapes” theoretically open data from sources like Customs Department CDs, for which it pays \$100 a day, and makes the data far more accessible by placing it on its website. (These CDs contain bills of lading for all shipments arriving in the country and help the company provide information on the types of goods being imported by US businesses.)

The company also devotes significant resources to enabling connections and comparisons among data that exists in nonstandardized formats. Ensuring standardization (and more generally data quality) is one of the chief goals of the company. Standardization is also one of the chief challenges confronting the company, which has joined the Data Transparency Coalition, an advocacy group that pushes for uniformity in public data formats. The founders of Enigma have said that if public information were better standardized, it would significantly enhance their ability to provide access to more, and more reliable, data.<sup>174</sup>

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171 Joel Gurin, “Interviewing the Hottest Startup, Enigma.io,” June, 2013, <http://www.opendatanow.com/2013/06/new-interviewing-the-hot-test-startup-enigma-io/#.U5oXoJRdUWE>, accessed October 1, 2014.

172 “About Us,” Enigma, <http://enigma.io/about/>, accessed November 12, 2014.

173 Natasha Singer, “A Harvest of Company Details, All in One Basket,” *New York Times*, March 15, 2014.

174 “Enigma Uses Disparate Data to Decipher Corporate Relationships,” Data Transparency Coalition, May 23, 2014, <http://datacoalition.blogspot.com/2014/05/enig-ma-disparate-data-decipher-relationships.html>.

**Sector and Market Segment:** Enigma operates in the data and technology sector and targets its offering to multiple markets, including B2C and B2B. Enigma's tools are used today by a variety of different kinds of users, including academic researchers, nonprofit organizations, government agencies, and financial analysts. Its data can be accessed through a web-based interface or through a set of APIs that enable third-party developers and companies to create more customized applications.

**Products and Revenue Model:** Enigma is a search engine for open data that offers the potential for unusual and powerful insights. Enigma's interface allows a user to type in a company name and view data (and connections between the data) from a variety of disparate sources. The ability to pull together such disparate sources of data can yield unusual insights. The *New York Times* cites the example of Lockheed Martin. An Enigma search reveals the size of government contracts received by this company (\$40.7 billion); the fact that the company's chief executive visited the White House five times, on two occasions to visit the president; and the fact that company employees donated \$51,000 to Obama's Presidential campaign. As the article puts it: *"Although these details may be unrelated, together they depict a politically influential and connected contractor."*<sup>175</sup>

Enigma also offers a variety of possible uses for SMEs and start-ups. For example, companies can use SEC and other public data available on the site to perform competitor analysis. Many of the data sets go in-depth in specific industries; companies operating in real estate, aviation and health care, for example, will find a number of industry-specific databases. In addition, Enigma includes public records on patents granted, licenses issued (e.g., liquor licenses and professional licenses), and other information that can prove invaluable to an existing business or those considering starting one.

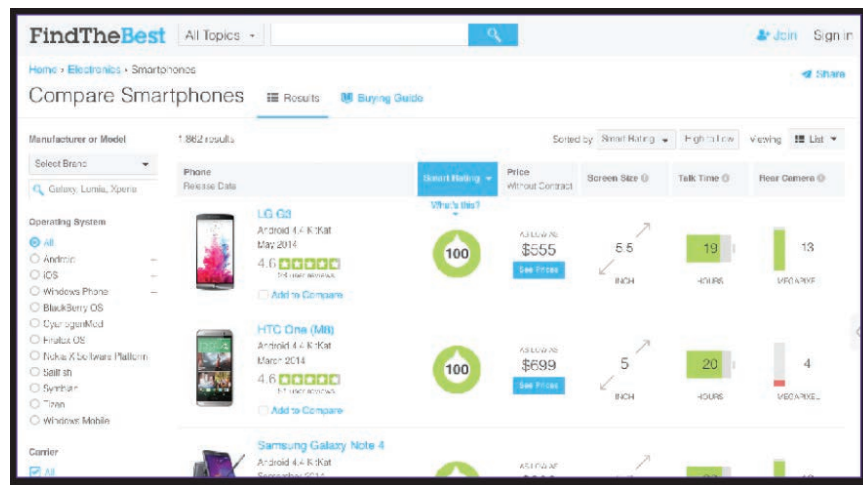
**Measuring Impact:** It goes without saying that open data plays an essential and direct role on Enigma. As an open data search engine, the company's value for its users increases as more data is open and shared. Each of these examples illustrates the power of bringing together and standardizing disparate sources of data. While Enigma's platform has the potential to affect a wide variety of sectors, business stands to be one of the sectors that can benefit most. Almost all the data included on the site can be broken up by region and date. This could allow, for instance, a company to investigate the potential of particular cities or states in which it is considering starting operations. There are two reasons why SMEs can be among the chief beneficiaries of the data offered by Enigma. First, SMEs, and start-ups in particular, often lack vast stores of data themselves. This can either be because young companies have not had a chance to collect data (e.g., on customer behavior) or because they lack the financial or technical expertise to collect and store data. Data retention can be an expensive proposition, and is often beyond the means of SMEs.

Second, SMEs often lack the technical and human capacity to analyze and make good use of data they may own or to which they may have access. Often overlooked in the enthusiasm surrounding open data (and, more generally big data) is the need to be able to make sense of that data. Analytics—the ability, for instance, to make links between different data sets, or simply to spot a signal amid noise—often requires a significant degree of training and expertise, and Enigma's sophisticated analytics tools in effect allow SMEs to outsource these functions to a third party.

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175 Steve Lohr, "Algorithms Get a Human Hand in Steering Web," *New York Times*, March 10, 2013.

### III.6 FINDTHEBEST | *FindTheBest.com*



**Value Proposition:** FindTheBest is a data-driven “comparison engine” that organizes and presents data to help consumers make decisions between products or services.<sup>176</sup> Kevin O’Connor, co-founder of DoubleClick, launched the site in 2010, seeking to create a search engine that would “filter out the excessive junk and present information in a simple, comparable way.”<sup>177</sup> Though the most popular search engine in North America continues to be Google, the popularity of machine-human collaborative search engines is increasing, as evidenced in the advent of Apple’s Siri and IBM’s Watson. FindTheBest is a comparative search engine that uses human-machine interaction to allow users to compare products and services across a number of different industries, including cars, colleges, investment and financial services, smartphones, and computers. FindTheBest also visualizes search results in a way that presents the differences and relative pros or cons among products being compared.<sup>178</sup> The goal of the company is to present data in a manner that is accessible and intuitive to users, and to guide them in their purchasing decisions.

**Open and Shared Data:** FindTheBest uses a variety of data sources as the basis for its search engine, including public databases (such as open government data), private databases, and primary sources like manufacturer websites.<sup>179</sup>

**Adding Value to Open and Shared Data:** With a wide and diverse source of data, the site’s main goal is aggregation and connecting otherwise disparate data sets. FindTheBest adds a layer to existing machine-human collaboration aids like Siri or Watson by providing visualizations that help consumers make choices. FindTheBest analyzes content for each product or service included in its database, writing summaries and designing the initial charts and graphs.<sup>180</sup>

FindTheBest is just one of many companies combining open government data with data culled from private databases. If users have questions about the data source for a particular listing, they can find the primary source for the information at the bottom of each comparative search result.<sup>181</sup> FindTheBest also crowdsources some of its data by allowing users to report inaccurate data when it is found in a search result.

<sup>176</sup> Steve Lohr, “Algorithms Get a Human Hand in Steering Web,” New York Times, March 10, 2013.

<sup>177</sup> Greg Sterling, “DoubleClick Founder Launches Structured ‘Decision Engine’ FindTheBest.com,” August 2, 2010.

<sup>178</sup> Erick Schonfeld, “FindTheBest Adds Smart Ratings and a Better Way to Compare Products,” TechCrunch December 7, 2011, <http://techcrunch.com/2011/12/07/FindTheBest-smart-ratings/>.

<sup>179</sup> “Where Does FindTheBest Get Its Data From?” FindTheBest, <http://support.FindTheBest.com/hc/en-us/articles/200193219-Where-does-FindTheBest-get-its-data-from>, accessed November 12, 2014.

<sup>180</sup> Steve Lohr, “Algorithms Get a Human Hand in Steering Web,” New York Times, March 10, 2013.

<sup>181</sup> “Where Does FindTheBest Get Its Data From?” FindTheBest, <http://support.FindTheBest.com/hc/en-us/articles/200193219-Where-does-FindTheBest-get-its-data-from>, accessed November 12, 2014.



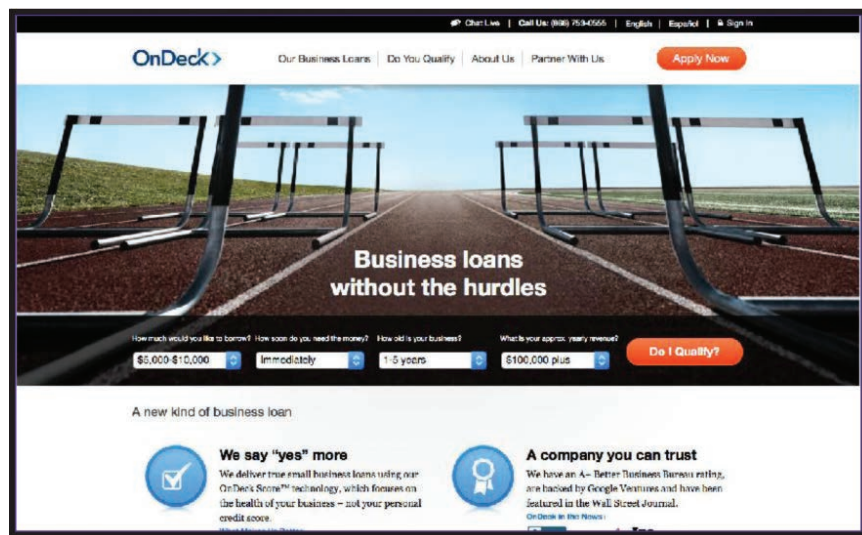
**Sector and Market Segment:** FindTheBest is in the Lifestyle and Consumer sector, and targets its product mainly to the B2C market. Most users come to the site with the intent of comparing different products and services, or to find out more information about a product or service. Though there are potential issues with biases in machine-human collaborative search engines, the aggregation of data by FindTheBest enables users to access and parse a wide array of data from disparate sources.

**Products and Revenue Model:** FindTheBest is a comparative search engine and data interface that enables consumers to compare prices and features between products. To use FindTheBest, users must create an account either by connecting their social media account, or by providing an email or password. Although the site is free to join, users do require a user name and password. FindTheBest's interface allows a user to type in a product, service, school, company, or other topic and receive a search result that includes information such as an overview of the company, the price of the product, specifications of the product, service or company, as well as other relevant information. Users can then compare one like product with another by pressing "compare" at the top of the page. The comparative search results provide information about both products along common dimensions such as user rating, price, primary genre, and supported devices. FindTheBest is free for its users, and uses primarily an advertising revenue model.

**Measuring Impact:** FindTheBest's search engine is informed by open government data and other public data to provide a comprehensive understanding of products and services. The company is quickly growing, now boasting eighteen different verticals, with comparative search engines on subjects ranging from Electronics, to Genealogy, to Travel and Lifestyle, and Weather.

The value added by FindTheBest is primarily in its aggregative and comparative format. It enables users to view data from a variety of disparate sources, providing visualizations to convey that data in a digestible format. Greater coordination between data sets can offer important insights not available within one publicly or privately held data set. FindTheBest provides consumers with evidence-based insight to inform a diversity of investment and purchasing decisions, and may have an effect on the wider US economy through helping consumers make more intelligent and cost-effective decisions.

### III.7 ONDECK | *OnDeck.com*



**Value Proposition:** OnDeck is an alternative lending company that provides short-term loans to small and medium-sized businesses, using open government data from a number of different sources, including the Department of Commerce, the

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Department of Labor, and the Small Business Administration. OnDeck began from a simple premise. Founder Mitch Jacobs, who had spent years developing software for small businesses, noticed that banks often refused credit to small and medium enterprises (SMEs). This was largely because the amount of effort involved in compiling information and assessing creditworthiness for small loans (e.g., \$50,000 or below) simply was not worth it for many financial institutions. The situation only became more acute during the nation's financial crisis, when banks became even more tightfisted and many healthy businesses were unable to access capital and grow.

OnDeck's efforts to address this problem began with the insight that the problem was not, in fact, one of creditworthiness or business potential, but rather one of information inefficiency and insufficient data. As Jacobs puts it, "I remember thinking, 'This is not a capital-and-credit problem. This is an automation problem.'"<sup>182</sup>

**Open and Shared Data:** OnDeck uses data from a variety of different sources, including data sets from the Department of Commerce, the Department of Labor, the Small Business Administration, and the Internal Revenue Service. In total, OnDeck aggregates data from between ten and fifty different government agencies and other related organizations.

**Adding Value to Open and Shared Data:** OnDeck uses data aggregation to automate the underwriting process, using a wider variety of data than typically used by financial institutions. While banks often look at an owner's personal creditworthiness, OnDeck uses data tied directly to the business itself: cash flows, credit profiles, legal history, vendor and payment history, and social profiles (e.g., a Yelp or other social media account). This information is assessed by OnDeck's proprietary algorithm to reach a score, which allows the company to make quick, data-driven loan decisions. The algorithm (in fact, there are several algorithms, as OnDeck uses different methods for different companies) is in many respects the company's secret sauce, a reminder of the fact that analytics and the ability to process data are often as important as the data itself.

**Sector and Market Segment:** OnDeck operates in the Finance and Investment sector, and provides services to the B2B market. OnDeck's user base is primarily small and medium-sized enterprises located in the United States seeking loans for their business. Businesses applying for loans must fulfill an additional set of criteria, such as a minimum credit score of 500, at least one year in business, and annual revenues of \$100,000 in the past twelve months.<sup>183</sup>

**Products and Revenue Model:** OnDeck provides loans to small and medium-sized businesses that qualify. In addition, the effort of gathering and compiling information for a loan application is considerably lower for companies that use OnDeck's process, an important consideration for small businesses that are often short on manpower and expertise. In many cases, loan applicants can simply upload their data using an online interface.

**Measuring Impact:** Founded in 2006, the company has grown rapidly and received widespread recognition. As of 2014, it has approximately 240 full-time employees, and in 2013 made \$475 million in loans to small businesses.<sup>184</sup> OnDeck's typical loan size is \$30,000, and its customers tend to have revenues ranging from \$100,000 to \$5 million.<sup>185</sup> According to the company's CEO, Noah Breslow, most borrowers tend to have fewer than 200 employees. They include "restaurants, auto body shops, doctor's and dentist's offices, construction contractors"<sup>186</sup>—a profile that reads like a representative list of the small and self-owned businesses that are in so many ways the backbone of the national economy.

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182 Benjamin J Spencer, "Small Biz Lender OnDeck Receives \$15M Boost," *OnDeck*, January 27, 2011.

183 "Are You a Small Business in Need of Fast Funding?" *OnDeck*, <https://www.ondeck.com/loan-qualifying/>, accessed November 12, 2014.

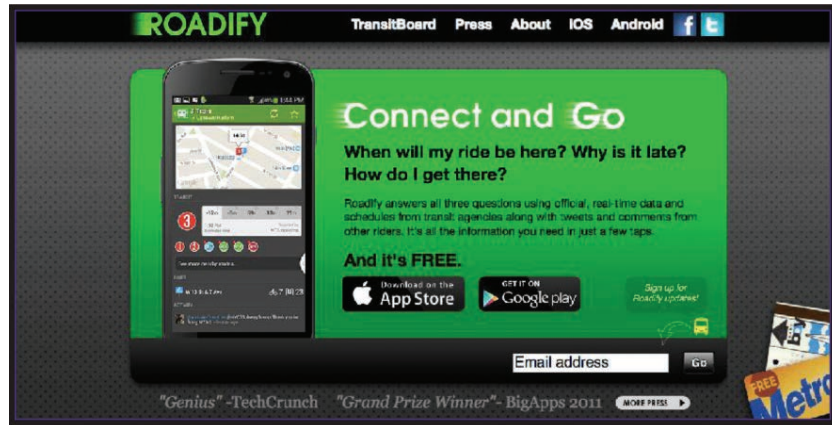
184 Patricia Clark, "OnDeck's Latest Deal Shows Banks Are Ready to Outsource Some Small Business Loans," *Bloomberg BusinessWeek*, May 9, 2014.

185 Phyllis Furman, "Online Small Business Lender OnDeck Has Locked In \$17 Million More in Funding to Fuel Growth," *New York Daily News*, May 1, 2013.

186 Arik Hesseldahl, "Google Ventures Leads \$17 Million Round in On Deck Capital," *All Things D*, May 1, 2013, <http://allthingsd.com/20130501/google-ventures-leads-17-million-round-in-on-deck-capital/>.

OnDeck is growing by innovating on the old (and in many respects staid) business model of traditional financial institutions. Public data is at the heart of its strategy, and its business plans to expand that strategy to develop products in the coming years to supplement its core loan assessment and loan-making tool.<sup>187</sup> In addition, the aggregated data that OnDeck has collected on SMEs over the years may itself prove increasingly valuable in developing new products and better targeting its services—a reminder that the right data strategy can be mutually self-reinforcing and enable a virtuous cycle of innovation and growth.

### III.8 ROADIFY | *Roadify.com*



**Value Proposition:** Roadify is a data platform and mobile application for transit information. Founded in 2009 by Nick Nyhan, the application seeks to combine a variety of on-the-ground transit information in one place, to help users find the best routes and prices for their transit needs.<sup>188</sup> The application was the winner of the 2011 NYC BigApps contest, a contest hosted by the City of New York's Economic Development Corp. and the New York City Department of Information Technology and Telecommunications.

**Open and Shared Data:** The site uses open transit data (including Staten Island Ferry and MTA data) from more than one hundred transit agency sources across the United States and Canada to provide up-to-date transit information for its users.<sup>189</sup> All of the data it makes available is already "open." However, the amount and complexity of open transit data available presents a challenge for analysis without an application to interpret and visualize the information.

**Adding Value to Open and Shared Data:** The main value added by the app is that it combines and aggregates information from a variety of different transportation sources, packaging it in a hyper-local, real-time way to customers through an XML feed. For instance, users in New York City can look up information from the MTA, as well as New Jersey Transit, the Staten Island Ferry, and Bike Share Stations. Official structured open transit data is input into the application through Google's General Transit Feed Specification (GTFS) format. Unstructured and crowdsourced data is also pulled from Twitter, from the comments provided by riders and agencies about particular transit systems and individual lines. Users also provide their own data to the app, alerting Roadify to transit operation abnormalities when encountered.

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187 Matthew Flamm, "Google Invests \$17M in OnDeck Capital," *Crain's New York*, May 2, 2013, <http://www.crainsnewyork.com/article/20130501/NEWS/130509995>.

188 Brady Dale, "Roadify: All-in-One Transit App to Launch Android Update," *Technical.ly*, March 28, 2014, <http://technical.ly/brooklyn/2014/03/28/roadify-transit-app/>.

189 "Roadify: A Transit Data Platform," *Commuter CODE*, September 24, 2013, <http://www.commutercode.com/2013/09/roadify-transit-data-platform.html>.

**Sector and Market Segment:** Roadify is in the Transportation sector, and markets primarily to consumers, though it also licenses its real-time streaming transit data to businesses. The user base for Roadify is quite broad and includes individuals who use mass transit in selected areas throughout the United States and Canada.

**Products and Revenue Model:** Roadify offers its users a free ad-supported mobile application and also licenses its data and software platform to businesses, such as the Barclay's Center in Brooklyn. The mobile application provides users with information about the location and timing of their public transportation. Roadify's plan is to add revenue by becoming a point-of-sale hub for transit agencies—users will not only be able to buy tickets from many transit authorities, but also hold their transit pass on their phone.<sup>190</sup>

**Measuring Impact:** Roadify's platform and applications would not be possible without access to open transit data. The company has the potential to have economic impacts beyond the mass transit system. In 2012, Barclay's Center in Brooklyn announced it would be using Roadify data to broadcast transit information for fans attending events at the stadium, on TV screens throughout the arena.<sup>191</sup> This transit information enables visitors to plan their travel times according to transit availability—meaning less-crowded train platforms and a potential for increased revenue through tourism, shopping, and eating in the surrounding areas, as visitors to the arena can plan around delays. The app also has consequences for parking and traffic, in that it makes it easier for visitors to leave their cars at home and opt for public transit instead.

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<sup>190</sup> Brady Dale, "Roadify: All-in-One Transit App to Launch Android Update," *Technical.ly* March 28, 2014, <http://technical.ly/brooklyn/2014/03/28/roadify-transit-app/>.

<sup>191</sup> Mark Morales, "Park Slope-Based Programmer Helps Arena Fans Make Quick Departure from Brooklyn," *New York Daily News*, September 26, 2012.

## Further Reading

Bonina, Carla. “New Business Models and the Values of Open Data: Definitions, Challenges, and Opportunities.” NEMODE 3K—Small Grants Call 2013.

In this paper, Dr. Carla Bonina provides an introduction to open data and open data business models, evaluating their potential economic value and identifying future challenges for the effectiveness of open data, such as personal data and privacy, the emerging data divide, and the costs of collecting, producing, and releasing open (government) data.

Capgemini Consulting. “The Open Data Economy: Unlocking Economic Value by Opening Government and Public Data.” Capgemini Consulting.

This report explores how governments are leveraging open data for economic benefits. Using a comparative approach, the authors study important open data from organizational, technological, social, and political perspectives. The study highlights the potential of open data to drive profit through increasing the effectiveness of benchmarking and other data-driven business strategies.

Carpenter, John, and Phil Watts. “Assessing the Value of OS OpenData™ to the Economy of Great Britain—Synopsis.” June 2013. Accessed July 25, 2014.

John Carpenter and Phil Watts of Ordnance Survey undertook a study to examine the economic impact of open data to the economy of Great Britain. Using a variety of methods such as case studies, interviews, download analysis, adoption rates, impact calculation, and CGE modeling, the authors estimate that the OS OpenData initiative will deliver a net increase in GDP of £13–28.5 million for Great Britain in 2013.

Deloitte. “Open Growth: Stimulating Demand for Open Data in the UK.” Deloitte Analytics. December 2012. [http://www.deloitte.com/view/en\\_GB/uk/market-insights/deloitte-analytics/bfb570a79416b310VgnVCM1000003256f70aRCRD](http://www.deloitte.com/view/en_GB/uk/market-insights/deloitte-analytics/bfb570a79416b310VgnVCM1000003256f70aRCRD). Accessed July 24, 2014.

This early paper on open data by Deloitte uses case studies and statistical analysis on open government data to create models of businesses using open data. They also review the market supply and demand of open government data in emerging sectors of the economy.

Gruen, Nicholas, John Houghton, and Richard Tooth. “Open for Business: How Open Data Can Help Achieve the G20 Growth Target.” [http://www.omidyar.com/sites/default/files/file\\_archive/insights/ON%20Report\\_061114\\_FNL.pdf](http://www.omidyar.com/sites/default/files/file_archive/insights/ON%20Report_061114_FNL.pdf). Accessed July 24, 2014.

This report highlights the potential economic value of the open data agenda in Australia and the G20. The report provides an initial literature review and case studies on the economic value of open data and a set of recommendations for how open data can help the G20 and Australia achieve target objectives in the areas of trade, finance, fiscal and monetary policy, anticorruption, employment, energy, and infrastructure.

Gurin, Joel. “The Current State and Future of Data-Driven Innovation, Report to the Chamber of Commerce Foundation.” July 16, 2014.

Joel Gurin describes the potential of data-driven innovation, emerging types of data and applications, and public policies that will encourage innovation in both private and public sectors moving forward. Gurin argues that growing sophistication in data-driven analytics and types of data are creating new kinds of market opportunities, public sector development, and business revenue streams.



Heusser, Felipe I. "Understanding Open Government Data and Addressing Its Impact (draft version)." World Wide Web Foundation.

The World Wide Web Foundation, in collaboration with IDRC, has begun a research network to explore the impacts of open data in developing countries. In addition to the Web Foundation and IDRC, the network includes the Berkman Center for Internet and Society at Harvard, the Open Development Technology Alliance, and Practical Participation.

Howard, Alex. "San Francisco Looks to Tap Into the Open Data Economy." O'Reilly Radar: Insight, Analysis, and Reach about Emerging Technologies. October 19, 2012. <http://radar.oreilly.com/2012/10/san-francisco-open-data-economy.html>. Accessed July 24, 2014.

Alex Howard points to San Francisco as one of the first municipalities in the United States to embrace an open data platform. He outlines how open data has driven innovation in local governance. Moreover, he discusses the potential impact of open data on job creation and government technology infrastructure in the City and County of San Francisco.

Huijboom, Noor, and Tijs Van den Broek. "Open Data: An International Comparison of Strategies." *European Journal of ePractice*. March 2011.

This article examines five countries and their open data strategies, identifying key features, main barriers, and drivers of progress for open data programs. The authors outline the key challenges facing European and other national open data policies, highlighting the emerging roles open data initiatives are playing in political and administrative agendas around the world.

Manyika, J., Michael Chui, Diana Farrell, Steve Van Kuiken, Peter Groves, and Elizabeth Almasi Doshi. "Open Data: Unlocking Innovation and Performance with Liquid Innovation." McKinsey Global Institute. October 2013. [http://www.mckinsey.com/insights/business\\_technology/open\\_data\\_unlocking\\_innovation\\_and\\_performance\\_with\\_liquid\\_information](http://www.mckinsey.com/insights/business_technology/open_data_unlocking_innovation_and_performance_with_liquid_information). Accessed July 24, 2014.

This research focuses on quantifying the potential value of open data in seven "domains" in the global economy: education, transportation, consumer products, electricity, oil and gas, health care, and consumer finance.

Moore, Alida. "Congressional Transparency Caucus: How Open Data Creates Jobs." April 2, 2014. Socrata. <http://www.socrata.com/blog/congressional-transparency-caucus-open-data-creates-jobs/>. Accessed July 30, 2014.

Socrata provides a summary of the March 24 briefing of the Congressional Transparency Caucus on the need to increase government transparency through adopting open data initiatives. They include key takeaways from the panel discussion, as well as their role in making open data available for businesses.

Stott, Andrew. "Open Data for Economic Growth." The World Bank. June 25, 2014.

In this report, The World Bank examines the evidence for the economic potential of open data, holding that the economic potential is quite large, despite a variation in the published estimates and difficulties assessing its potential methodologically. The report provides five archetypes of businesses using open data, and provides recommendations for governments trying to maximize economic growth from open data.



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