IBM Center for The Business of Government

Integrating Big Data and Thick Data to Transform Public Services Delivery

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Associate Professor of Political Science
at the University of Michigan

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TABLE OF CONTENTS

FOREWORD

On behalf of the IBM Center for The Business of Government, we are pleased to present this new report, *Integrating Big Data and Thick Data to Transform Public Service Delivery,* by Yuen Yuen Ang, Associate Professor of Political Science at the University of Michigan.

Organizations and researchers across the private and public sectors have learned much from advances in the use of analytics to assess a vast and growing volume of information. "Big data" enables understanding of patterns and anomalies with far greater speed and accuracy, and has been used to help government make more informed decisions in areas ranging from social service delivery to global threats. Yet while big data has been the source of significant advances, its very nature does not capture deep context about the people and places who benefit from actions taken based on analysis of big data.

DANIEL J. CHENOK

In this report, Professor Ang offers a new framework to enhance government's ability to leverage big data for social and economic good by integrating the concept of thick data—defined as "rich qualitative information about users, such as their values, goals, and consumption behavior, obtained by observing or interacting with them in their daily lives." The author reviews the differing strengths and limits of big and thick data, and suggests that governments can improve results by combining the breadth of big data with the depth of thick data—an integrative approach that she calls "mixed analytics," which can increase accuracy in interpreting big data by adding contextual knowledge about citizen concerns.

LEANNE HASELDEN

The report uses three case studies to illustrate how mixed analytics can help improve decision-making that affects the daily lives of citizens across the public sector, at the local, national, and international levels. Professor Ang concludes with a set of lessons learned and recommendations for government leaders, which range from making data and technology relevant to users, and applying big and thick data at different stages of the problem-solving process, to building interdisciplinary teams that include both quantitative and qualitative experts and that engage stakeholders in collecting and analyzing data.

This report builds on multiple past IBM Center reports about how government can leverage data and analytics to improve decisions, including Data-Driven Government: The Role of Chief Data Officers, by Jane Wiseman; Ten Actions to Implement Big Data Initiatives: A Study of 65 Cities, by Alfred Ho and Bo McCall, and Realizing The Promise of Big Data, by Kevin DeSouza. The report also complements several chapters that assess the past and potential use of data across the public sector in our recent book, Government For The Future: Reflection and Vision For Tomorrow's Leaders.

At a time when the US and other governments continue to enhance their use of data as a strategic asset for transformation, we hope that Professor Ang's report provides useful insights for government managers and stakeholders.

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EXECUTIVE SUMMARY

Governments can greatly enhance the value of big data by combining it with "thick" data—rich qualitative information about users, such as their values, goals, and consumption behavior, obtained by observing or interacting with them in their daily lives.

Big data holds great promise for improving public services delivery and innovation in government, but they are not a panacea. Having lots of data can be overwhelming or have little utility if the data are "thin"—that is, they lack meaning for users or fail to capture issues that matter most. By yielding insights into what citizens really care about and how they consume services, thick data can inform both the collection and analysis of big data.

This report introduces the concept of "mixed analytics," integrating big data and thick data to transform government decision making, public services delivery, and communication. The report presents three case studies of organizations that employ mixed analytics at the international, federal, and city level, respectively. Together, this research offers a set of transferable lessons for agencies at all levels of government:

- Lesson 1: Big data is a means to an end, rather than an end.
- Lesson 2: Thick data can identify unexpected problems or previously unexpressed needs.
- Lesson 3: Thick data can inform the analysis of big data.
- Lesson 4: Mixed analytics can offer both scale and depth.
- Lesson 5: Applying technology is a social activity, not an isolated technical task.
- Lesson 6: The best solutions are not always high-tech.

The report concludes with five actionable recommendations for public managers.

1. Make data and technology relevant to the people who use it.
2. Leverage thick data at appropriate stages of the problem-solving process.
3. Build an interdisciplinary team of quantitative and qualitative experts who work closely with stakeholders.
4. Combine big and thick data to improve communication.
5. Improve government agencies' knowledge of mixed research methods.

INTRODUCTION

Big data has revolutionized the delivery of business and government services. But what's missing?

Corporations have harnessed big data and analytics to improve business operations and marketing. The public sector, meanwhile, is slowly—but steadily—catching up. Earlier reports from the IBM Center for The Business of Government highlight the promise of big data in helping public organizations "streamline business processes, increase citizen engagement, innovate, and embrace evidence-driven decision-making." [1] They show that across the United States, a growing number of cities collect and use big data to inform policies and program management.[2]

But governments should not be swept away by the promise of big data as a panacea. Data can be overwhelming or have limited utility if the data are "thin"—that is, they lack meaning for citizens, businesses, or other users. Focusing only on big data may distract agencies from noticing what really matters to people. As one *New York Times* op-ed puts it:[3]

> If you're trying to build a self-driving car or detect whether a picture has a cat in it, big data is amazing. But here's a secret: if you're trying to make important decisions about your health, wealth or happiness, big data is not enough. The problem is this: the things we can measure are never exactly what we care about.

When it comes to delivering public services, governments can miss obvious problems if they rely only on big data and analytics. For example, consider the "smart parking" programs adopted by the cities of New Orleans, Palo Alto, and San Francisco. Using big data on parking availability, algorithms automatically adjusted parking prices according to supply and demand—prices rose with high demand and fell with low demand.

But drivers did not take full advantage of dynamic pricing. To explore why not, a team of ethnographers spent several weeks in each city observing parking behavior and trying out the parking process themselves. Their research revealed a problem that smart technology had missed: confusing parking signs meant that drivers did not want to park at certain spots, even with lower prices.[4] The easy solution to this unexpected problem was designing clearer parking signs.

Technologists often operate on certain assumptions about user preferences and behavior, but these assumptions may turn out to be biased or rooted in misunderstandings. As the above

1. Kevin Desouza, "Realizing the Promise of Big Data: Implementing Big Data Projects," *IBM Research Report,* 2014, pp. 10.
2. Alfred Tat-Kei Ho & McCall Bo, "Ten actions to implement big data initiatives: A study of 65 cities," *IBM Research Report,* 2016.
3. "How Not to Drown in Numbers," *New York Times,* May 2, 2015.
4. Glasnapp, J. & Isaacs, E. (2011). "No More Circling Around the Block: Evolving a Rapid Ethnographic and Podcasting Method to Guide Innovation in Parking Systems," Proceedings of Ethnographic Praxis in Industry Conference (EPIC) '11, Boulder, CO.

example illustrates, the dynamic pricing design assumed that drivers care most about parking costs; in fact, they may be more concerned about quickly finding secure and convenient spots to park.

Although big data enables computational analyses and predictive analytics that exponentially exceed human cognition, they do not diminish or negate the role of human observation and immersion in social settings. In order to leverage *big data* to improve government services, policymakers can combine it with *thick data*. Drawing on anthropology and ethnography,—thick data refers to rich qualitative information about users, such as their values, goals, and consumption behavior, obtained by observing or interacting with them in their daily lives.

Whereas big data are broad and thin, thick data are narrow and rich—blending them therefore yields a more holistic picture of the problem at hand. Indeed, major technology companies have used mixed data for decades, a fact often missed in forums about big data. For example, in addition to generating big numerical data on likes, clicks, and shares, social media companies also collect thick data on why users perform certain activities and the meaning of those activities, through interviews and surveys conducted by an ethnographic research team.[5]

Previous IBM Center reports have featured big data initiatives in government. This report focuses on how public organizations can combine big data and thick data to transform public services delivery, including services that address citizen needs such as transportation, health care, and law enforcement—a strategy this report calls *mixed analytics.* Although "analytics" often connotes the use of numerical data for decision making, governments should adopt a broader understanding of data that includes non-measurable insights.

To illustrate how mixed analytics operate in practice, this report analyzes and draws lessons from three case studies at the international, federal, and city levels, respectively.

- The World Bank Social Observatory's p-tracking (participatory tracking) project among 32,000 village residents in India.
- The APHIS (Animal and Plant Health Inspection Service, a division of the United States Department of Agriculture) tailored social marketing campaign.
- The LA Express Park program, featuring dynamic pricing, in downtown Los Angeles.

These case studies show that mixed analytics can help public institutions increase citizen engagement, tailor messages to differentiated audiences, and ensure that services truly reach and benefit citizens. Organizations may sometimes have big data on things that do not really matter and yet lack data on issues that matter most. Hence, to be relevant, governments must acquire not only data literacy but also contextual literacy—deep understanding of a particular context—by talking to stakeholders, observing people, and immersing in local communities.

The report contains three main sections:

1) An analysis of the uses and limitations of big data, and how integrating it with thick data can generate holistic insights and better results for public managers.
2) Presentation of the three case studies that illustrate the power of integrating big data with thick data.
3) Lessons learned and recommendations for government action.

5. *New York Times,* May 2, 2015. Other companies that have combined big and thick data to improve operations and marketing include Xerox, Intel, Google, and Netflix.

Part 1
Analytical Perspectives on Big Data and Thick Data

The Uses and Limitations of Big Data

Big data can be described as "massive data sets sifted by powerful analytical tools."[6] Emerging in the 2000s, the concept of "big data" took off with growing digital records of individual and organizational activities, enabled by the proliferation of data collection devices, such as digital cameras, smartphones, and scanners.[7] Social media generates unprecedentedly large databases of text and online interactive behavior, while the expansion of broadband and wireless networks accelerates real-time transmission of data. All of these infrastructure advances and new modes of communication have made big data possible.

Big data is defined not only by volume (the amount of data collected and analyzed), but also by velocity and variety. Velocity refers to the speed of data being produced, for example, streaming data is now widely available for real-time, instant analysis. Variety refers to the different forms of data collected, which can be structured or unstructured, and the number of dimensions captured by the data. As Helm underscores, "Big data is more about the complexity of data, rather than the size of the data alone."[8]

Big data can also be divided into two categories: "tall data" and "fat data." Tall data feature "a large number of observations relative to the number of predictors."[9] The data used for APHIS's social marketing campaign, one of the case studies featured in this report, illustrates the use of tall data: the dataset has hundreds of thousands of observations (records of violations) but relatively few predictors (variables that can potentially explain the violations). Usually, when people think about big data, they really mean tall data. A different kind of big data is fat data, which has "lots of variables but few cases."[10]

In recent years, big data has garnered the attention of government leaders and managers. In 2012, the Obama administration announced the Big Data Research & Development Initiative, allotting $200 million to launch new big data projects. Such efforts have been supplemented by certain agencies who must provide large data sets to the public at no cost, such as the National Oceanic and Atmospheric Administration at the Department of Commerce.

Federal, state, and local governments have all begun to use big data in a variety of ways. A federal example is the United States Postal Service (USPS). USPS processes more than 6,100 mailings each second. By feeding a massive database of 400 billion records to an algorithm, USPS can detect fraud and suspicious mailings.[11] Locally, big data can be used for predictive policing. Applying software to crime statistics can generate predictions of where crime is likely to occur, enabling the police to act preemptively.[12]

But while success stories of big data applications abound, reports about their limitations are less common. In fact, even in the private sector, failures occur. One problem involves collecting a massive amount of useless information. Eager to jump onto the big data bandwagon, one medical company collected as much data as possible without first setting priorities and planning quality checks, resulting in a 200-page data analytics report that lacked the necessary insights.[13]

6. "The Power of Thick Data," *Wall Street Journal,* March 21, 2014.
7. Ho & McCall 2016, pp. 6.
8. John Helms, "Big data: it's about complexity, not size," IBM Business of Government Blog, Jan. 22, 2015.
9. Brian Griepentrog, Sean Marsh, Sidney Carl Turner & Sarah Evans, "Using social marketing and data science to make government smarter," in *Computational Social Science: Discovery and Prediction,* edited by Michael Alverez, New York: Cambridge University Press, 2016, pp. 262.
10. Ibid, pp. 247.
11. Desouza 2014
12. Jennifer Bachner, "Predictive Policing: Preventing Crime with Data and Analytics," *IBM Research Report,* 2013.
13. Volodymyr Fedak (CEO of IT Svit), "Big Data misuse can break your business," IT Svit Blog, Feb 23, 2018, https://itsvit.com/blog,

As one industry executive has cautioned, "Just having massive amounts of data is not sufficient—in fact, without the proper analytic tools, it can lead to information overload."[14]

Blindly relying on algorithms that draw from big data can lead to biased and poor decisions, particularly because most people, even top managers, do not question how algorithms work. One study finds that automated processing of job applications can systematically introduce bias against certain groups, even though "most companies do not intentionally engage in discriminatory hiring practices." Relying on algorithms as a "quick fix," the study cautions, steers companies away from tackling the root issues of workplace diversity.[15]

Most importantly, big data sets may not capture what consumers really want, particularly if core consumer preferences have not yet been noticed or expressed. Companies collect data according to what they believe customers want most, but these assumptions can be wrong.

Consider the case of a large supermarket chain that attempted to identify reasons for falling sales. The firm conducted customer surveys about pricing and competition, factors it assumed to be most relevant, but the survey produced contradictory results.[16] Baffled, the firm tried a different method of investigation: sending ethnographers to observe consumers while shopping and in their homes. This study discovered that shoppers wanted something completely missing in the conventional survey: "Shopping experiences that were both convenient and distinctive—in other words, a mood." Informed by this surprising insight, the supermarket redesigned its stores to enhance their "mood," thereby gaining a powerful advantage over its competitors. This demonstrates the value of thick data in uncovering previously unexpressed needs.

What Is Thick Data?

If big data reflects volume, velocity, and variety for items that can be counted, thick data concerns information about the significance, meaning, and connections that humans assign to services or technologies, as well as the process by which they consume them. Thick data is generated through immersion in users' natural settings, rather than in laboratory-type settings.

This concept of thick data draws from a well-established body of knowledge and research methodology in anthropology. According to the American Anthropological Association, "Anthropology is the study of what makes us human. Anthropologists take a broad approach to understanding the many different aspects of the human experience…Anthropologists also try to understand how people interact in social relationships."[17] Put more simply, anthropology attempts to understand the human experience holistically, as opposed to only narrow, isolated aspects of daily living.

14. Helms 2015
15. Alex Rosenblat, Tamara Kneese, and danah boyd. "Networked Employment Discrimination." *Data & Society Working Paper,* October 8, 2014.
16. "Big Data is Only Half the Data Marketers Need," *Harvard Business Review,* November 16, 2015.
17. Website of the American Anthropological Association, What is Anthropology?' Accessed November 2018 at https://www.americananthro.org/AdvanceYourCareer/Content.aspx?ItemNumber=2150

"Thick description" is a foundational concept in anthropology, first coined by Gilbert Ryle and later revived and popularized by Clifford Geertz, a leading anthropologist. Thick description, Geertz explains, interprets the "hierarchy of meaningful structures" that lies behind people's words and actions.[18] He illustrates this concept with the famous example of winks. A thin description of winks is a contraction of eyelids; a thick description, on the other hand, interprets what message the winker tries to convey, to whom, and why. Data, according to Geertz, "are really our own constructions of other people's constructions of what they and their compatriots are up to."

Generating thick data requires the simple act of observation, a primary tool of ethnography —a branch of anthropology committed to the "exploration of a particular social or cultural setting on the basis of (though not exclusively by) participant observation."[19] Leading companies have applied ethnographic techniques to motivate and refine product design, creating a subfield known as "design ethnography." An official at IBM's Almaden Research Center recalls that when computing technology took off in the 1980s, ethnography techniques were already employed to understand how people interacted with machines. Ethnographers helped engineers to bridge the gap "between how machines were designed to be used and how they were actually used."[20]

Integrating Big Data and Thick Data

Table 1 compares the attributes and functions of big data and thick data. Each of their differences shown in the table is discussed below.

- **Format and volume of data.** Whereas big data comprise numerical data, thick data usually come in a variety of non-numerical formats, including observations, interviews, field notes, photographs, videos, transcripts of focus group discussions, and experiences from direct participation. The two data formats are not strictly separate, as qualitative data (such as words) can be coded and turned into numbers for quantitative analysis. Generally, a trade-off exists between the volume and depth of knowledge— for example, we either know a lot about a few people or a little about numerous people. Thick data usually focuses only on a small number of subjects, or what social scientists term "small-n" studies.
- **Method of data collection.** Computational and data scientists can analyze big data anywhere, so long as they have the data sets and the right equipment. By contrast, ethnographers usually collect thick data through deep immersion in the site of investigation. Typically, anthropologists spend years in a single location, though design ethnographers often shorten the immersion process to a few intensive weeks.

18. Geertz, Clifford. *The Interpretation of Cultures.* New York: Basic Books, 2000.
19. Lynda Mannik & Karen McGarry. *Practicing Ethnography.* University of Toronto Press. 2017.
20. *Inverse Innovation,* 2016.

Table 1: Big data vs. Thick Data

	Big Data	Thick Data
Format of data	Data in numerical format	Data in non-numerical, qualitative format
Volume	Usually large, even massive number of observations	Usually small number of observations
Methods of data collection	Digital records, digitized archival records, streaming data, transmission logs, numerical data scrapped from the Internet and social media	Participant observation, direct participant interviews, focus groups, small-n open-ended surveys, video recordings, qualitative data from the Internet and social media
Analysts	Research by social and computational scientists	Research by anthropologists and ethnographers
Immersion Requirement	Analysts need not be on-site to analyze the data	Usually on-site or direct observation online, and immersed in context (observing, participating, talking to people)
Role in problem solving	Generate solutions to largely known problems, such as by mapping behavioral patterns, making predictions, generating automated decisions	Identify problems that matter most to stakeholders, particularly unknown problems and previously unexpressed needs, and test solutions before scaling up
Strengths	Scale: generate insights that are generalizable to a large portion of or an entire population	Depth: identify what stakeholders care about in the first place; paint a holistic picture of certain experiences

Source: Yuen Yuen Ang

- **Role in problem solving.** Big data and thick data also differ in the problem-solving functions they serve. Generically stated, any process of problem solving may be disaggregated into four steps:[21]

  1) Identify problems that matter to users or stakeholders.
  2) Propose solutions to the problems.
  3) Test and refine solutions on a small scale.
  4) Implement solutions on a large scale.

  Big data is extremely useful for generating solutions to problems that are already known or obvious, but unclear problems call for collecting thick data through qualitative research methods.[22] For example, in the case of LA Express Park (see Case 3), if traffic congestion were indeed caused by rigid pricing, big data and algorithms could be used to automate dynamic pricing. Yet in fact, motorists were more concerned about convenience and not

21. See also Yuen Yuen Ang, "Going Local 2.0: How to Reform Development Agencies to Make Localized Aid More than Talk," *Stanford Social Innovation Review,* October 8, 2018.
22. Grant McCracken, an ethnographer who works for Netflix, describes his role as Chief Cultural Officer, that is, as the "corporation's eyes and ears, allowing it to detect coming changes, even when they exist only as the weakest of signals." (Cited in Tricia Wang. "Why Big Data Needs Thick Data." *Ethnography Matters.* May 13, 2013. See also, Tricia Wang, "The Human Insights Missing from Big Data," Ted Talk (video), Posted September 2016.)

getting towed (matching step one above—identify an unexpected problem that matters to users) than the expected problem of price (matching step two—propose the solution of clarifying parking signs).[23]

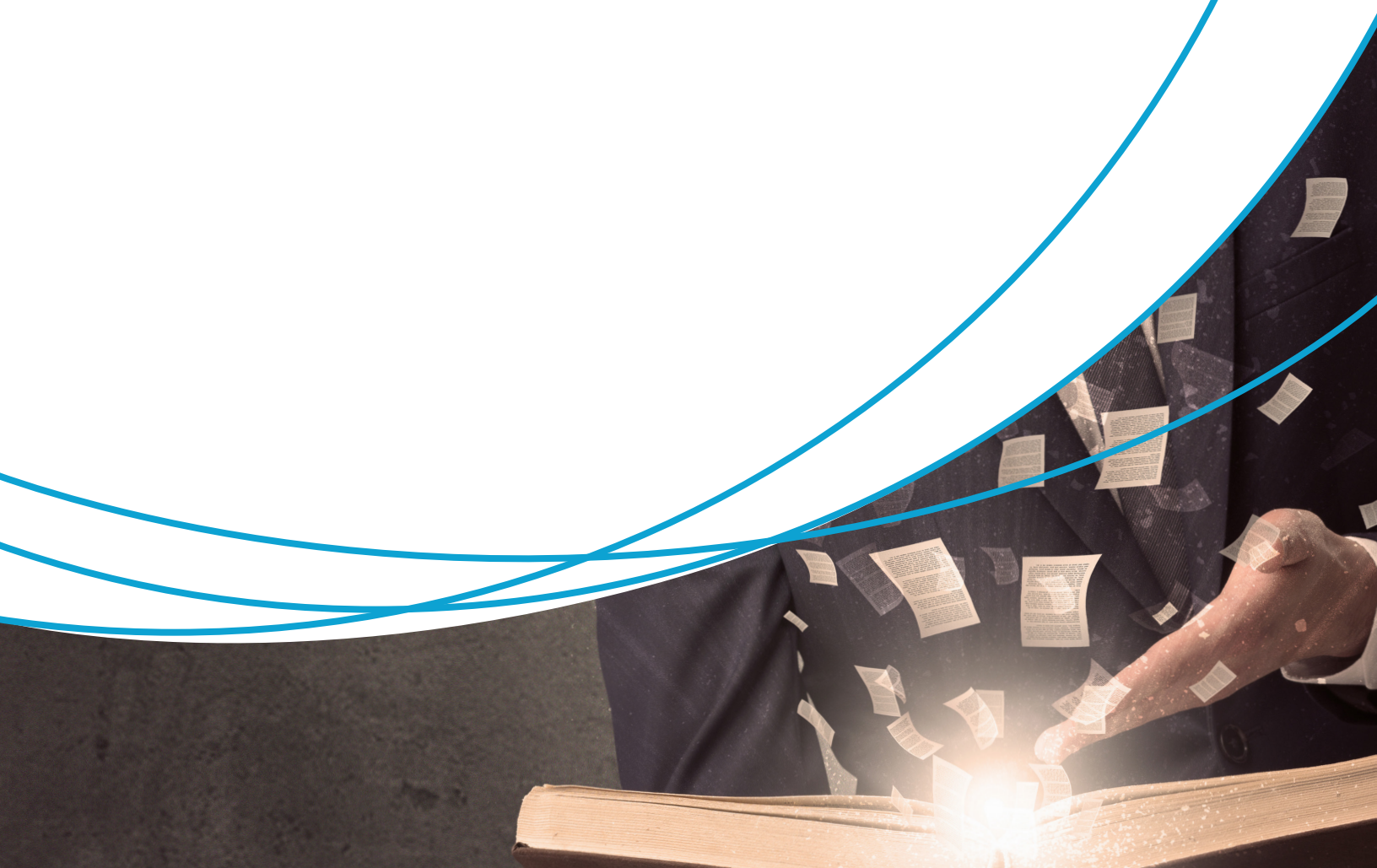
Thick data are also particularly relevant for the third step of problem solving: testing and refining solutions on a small scale. As Ken Mihalyov, chief innovation officer for Xerox Transportation, cautions, "There's very often a difference between what you expect to happen and what's actually happening when people are involved."[24] Before introducing a technology or product at scale, ethnographers can examine users' reaction and identify necessary adjustments. Making mid-course corrections is far less difficult and costly than correcting errors after a program fully launches. In the final fourth step—scaling up—big data and analytics can be usefully deployed to map behavioral patterns, generate predictions, and target communication.

- **Strengths and limitations.** Generally, big data and thick data have opposite strengths and weaknesses. In the words of Tricia Wang, a technology ethnographer, big data has the advantage of scale while thick data provides resolution: "For businesses to form a complete picture, they need both big and thick data because each of them produce different types of insights at varying scales and depths".[25] Big data can generate insights that apply to a large portion or even all of a population. Thick data, on the other hand, can identify what this population cares most about, and can help to generate a holistic picture of their experiences.

Any debate about the merits of big data versus thick data (or quantitative versus qualitative research) presents a false dichotomy. Both are necessary, and each serves unique purposes at different stages of the problem-solving process. This insight matters not only for researchers but also for practitioners. In particular, public managers can combine the two types of data. To draw lessons and recommendations, the next section analyzes three case studies.

23. James Glasnapp, Honglu Du, Christopher Dance, Stephane Clinchant, Alex Pudlin, Daniel Mitchell, and Onno Zoeter (Palo Alto Research Center [PARC]), "Understanding Dynamic Pricing for Parking in Los Angeles: Survey and Ethnographic Results," HCIB/HCII 2014, LNCS 8527, pp. 316–327, 2014 , pp. 317.
24. Kerschberg, B. "How Xerox Uses Analytics, Big Data and Ethnography To Help Government Solve Big Problems." Forbes. October 22, 2012.
25. Wang 2013. In this report, I go further to add that big data and thick data not only have different advantages, they serve different problem-solving functions.

Part 2
Three Case Studies



CASE A: A WORLD BANK SOCIAL OBSERVATORY

> *Don't try to be smart and cool—try to be relevant.*
>
> —**Vijayendra Rao,** Lead Economist at World Bank and Team Leader of the Social Observatory

This report's first case examines the World Bank's Social Observatory (SO), a division of the World Bank Research Group, which has developed a unique mixed-methods approach to data collection, data sharing, and the design of development assistance programs. Their work centers on improving existing "livelihood projects" in India that aim to reduce poverty and empower local communities. The SO operates through an international, multi-layered context of partnerships, involving World Bank researchers, state authorities in India at various levels, and grassroots communities. They seek primarily to help rural women, who face low income and low literacy in a male-dominant society.

Background and Motivations

Departing from mainstream practices at the World Bank and in international development generally, the SO boasts several distinct goals and features:

1) **"Embedded research,"** which the SO team defines as an effort to "teach people how to do research within the communities."[26] Embedded research presents a groundbreaking step in bridging the long-standing gap between communities in developing countries and decision makers from organizations in developed countries.

2) **A multi-method approach,** combining surveys with large populations, case studies, and field-based decision making by local participants and stakeholders. This work is planned and implemented by an interdisciplinary team of economists, sociologists, behavioral scientists, and information system specialists—breaking with the Bank's norm, where economists have traditionally dominated.

3) **Improving the "adaptive capacity"** of the communities with whom they work, through the mechanisms of "see, learn, and adapt." Rather than merely provide financial and technical assistance, the SO wants to help these communities become "nimble, learn by doing, and make mid-course corrections in implementation and design."[27]

The SO emerged in response to growing critiques of the standard methods employed in international development. The Observatory represents a departure from the World Bank's prioritization of randomized control trials (RCTs) as a primary means of impact evaluation. RCTs have held immense appeal to policymakers who believed that by proving the causal impact of particular interventions (such as a nutrition program or participatory scheme), these can scale up to work across larger communities and even entire countries. But after years of practice, critics grew concerned that RCTs fail to account for the larger, complex context in which interventions are applied.[28] Moreover, decision makers and analysts who design development programs

26. World Bank Social Observatory Website, Video, "The SO Leads to More Effective Projects."
27. World Bank Social Observatory Website, "About Us."
28. Jeff Tollefson. "Can randomized trials eliminate global poverty?", *Nature (News Feature),* August 12, 2015.

based on RCT results often live and work far from the communities they intend to help.[29]

Apart from criticisms of RCTs, concerns arose about existing participatory projects, intended to give communities direct control over key project decisions. Such projects form an important part of development assistance, taking up about seven billion dollars in World Bank's portfolio.[30] But this huge investment met with weak evidence of impact, and such projects often ended up usurped by local elites.

Vijayendra Rao, a lead economist in the Research Department of the World Bank and who directs the SO, recounted, "The vice president for South Asia at the time said, 'It's easy to criticize, but why don't you fix it?"[31] The SO was then established in 2011 as a joint initiative between the World Bank Research Department and the Bank's South Asia Livelihoods team, charged with selecting and improving upon two livelihood projects from World Bank's existing portfolio. This report will focus on the Pudhu Vaazhvu Project (PVP) in the Indian state of Tamil Nadu.

Participatory Tracking

At the heart of the SO's efforts to build adaptive capacity lies "participatory tracking" (p-tracking for short), an annual data collection system for tracking indicators of livelihood and empowerment among pre-existing women's self-help groups (SHGs). These SHGs integrate with village governments in that the chairperson of each SHG also heads the village council. Village meetings result in decisions about budgets and public goods projects, which directly impact citizens' lives. In partnership with the government of Tamil Nadu, SO launched a pilot in one district, covering 80 villages and 32,000 residents.[32]

For the pilot, the main quantitative data collected came from a census survey of the residents, conducted for a baseline and follow-up studies. The survey had seventy questions, yielding about 100 variables.[33] In addition, the researchers taped all the village and SHG meetings, generating a large cache of text data to be analyzed using machine learning techniques.

Unlike traditional community-based development assistance, SO coordinator Nethra Palaniswamy explains that p-tracking is "participatory, both in design and implementation." This involves three distinct steps: (1) local women participate in designing a questionnaire for themselves, (2) the collected data is validated to ensure accuracy, and (3) the data is shared with the communities to aid their decision making, project implementation, and provision of public goods. In each of these steps, analysts enrich and utilize the survey data through immersion in the field.

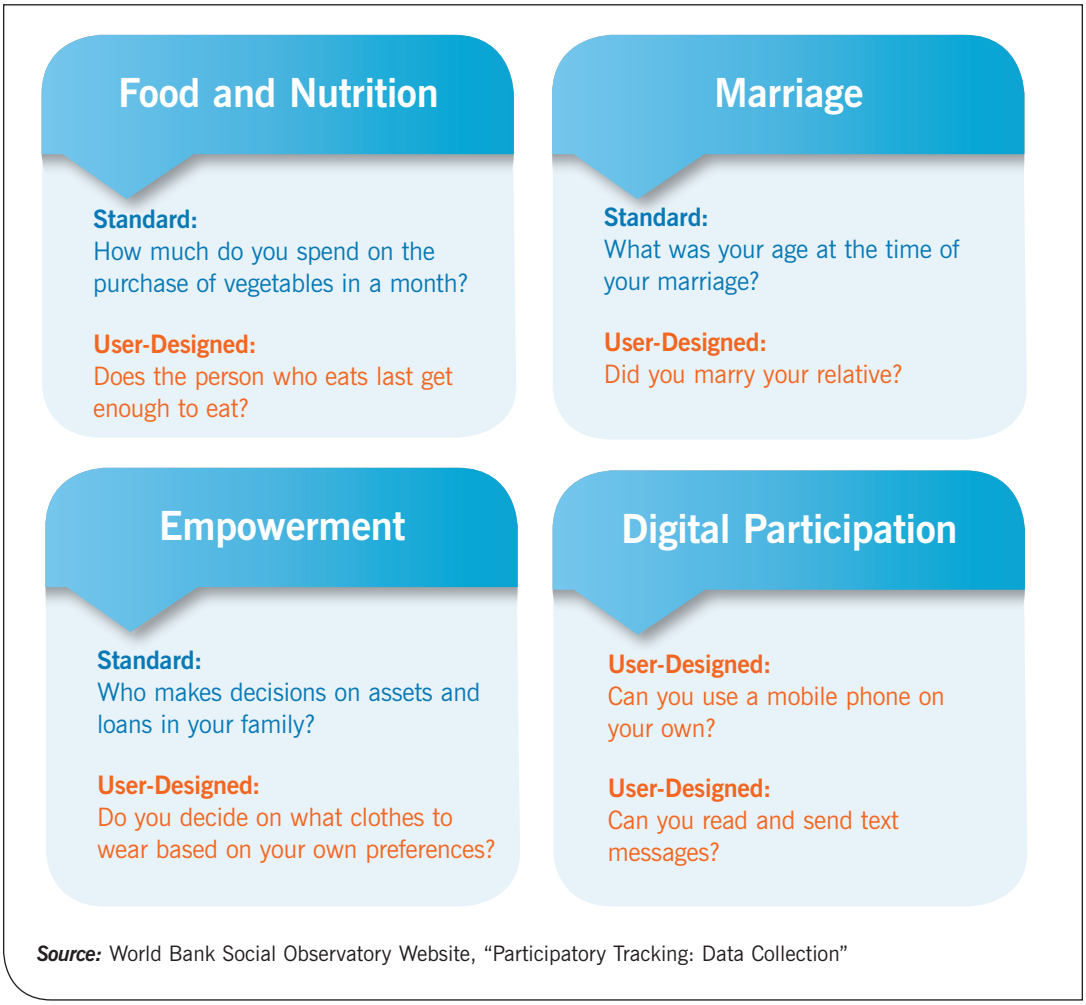
Surveys designed by outsiders, particularly by analysts who work with communities in the developing world, often suffer from two common problems: the surveys fail to measure what matters to people on the ground, and survey questions are phrased in ways that make no sense to the local residents. Mitigating these problems, the SO team took the innovative step of involving the local women, through SHGs, to design their own survey. As Palaniswamy describes, "We have a set of outcomes that we as analysts want to track, but the question is, what would they—the women—want to know about themselves?"

29. Angus Deaton & Nancy Cartwright. "The limitations of randomized controlled trials." VOX (CEPR's Policy Portal). November 9, 2016.
30. Ghazala Mansuri & Vijayendra Rao. 2004. "Community-based and Driven Development: A Critical Review," World Bank Policy Research Paper No. 3209. World Bank, Washington D.C.
31. Unless otherwise indicated, all direct quotes in this case study draw on the author's interviews with Vijayendra Rao (March 21, 2018) and Nethra Palaniswamy (April 5, 2018), researchers at the World Bank.
32. World Bank Social Observatory Website, "Participatory Tracking: Data Collection."
33. Interview with Palaniswamy

To implement this first step, the researchers recruited two community mobilizers from each village to lead focus group discussions among local women, asking them to address "what they would consider to be good lives,"[34] their "aspirations", and "things they dreamed of."[35] Afterward, larger groups of 70-100 women convened in a common place for more discussion, observed by the research team. The next step involved converting the ideas and inputs from the focus groups into survey questions, with the ultimate aim of designing a survey that would take 30 minutes to complete. The researchers then consulted the women for their opinions about the draft survey. After several iterations, they arrived at a final version that covered a range of issues, from women's agency at home to nutrition, sanitation, and more.[36]

Especially unique to this survey, questions were framed in ways that reflected the daily realities and most pertinent issues facing the rural Indian women who comprised the respondents. For instance, whereas standard consumption surveys ask, "How much did you spend on food per month?", the PVP survey asks, "Does the person who eats last get enough to eat?" (More examples are shown in Figure 1.) An example that struck Palaniswamy most involved measuring empowerment and survey question that the women themselves proposed: "Can you choose the clothing you want to wear on your own?"

Figure 1: Standard vs. designed-by-participants survey questions



Source: World Bank Social Observatory Website, "Participatory Tracking: Data Collection"

34. Ibid
35. World Bank Social Observatory Website, Video, "Democratizing Data to Empower Communities."
36. Interview with Palaniswamy

Figure 2: Recruiting local residents to implement the survey

Source: World Bank SO Website, "Participatory Tracking: Data Collection"

The final survey was implemented by community SHG trainers who lived in the villages where data was collected. The trainers were tought to conduct the survey using tablets and mobile phones, which automatically transmitted survey results to a central computer system. Having villagers collect data from fellow villagers presents another innovation, as opposed to surveys taken by foreign staff members that can feel alienating and intimidating to local residents. By contrast, as the PVP survey...community, the data collection process "felt like a social event," Palaniswamy describes. Another advantage of this method is that locals are invested in providing and monitoring good-quality data. As Rao stresses, "The people in whose interest it is to keep the data true are the women from these communities."[37]

Giving Data Back to the Communities

Following collection, all of the data went back to the communities through visualizations that the local women understand. This particular step resembles open government initiatives in the U.S, where a growing number of city governments have created platforms that visualize data on various topics and the delivery of program goals, using easy-to-read figures.[38] The Indian context differs from the U.S. initiatives in that data visualization occurs at the village level, tailored to rural women with low literacy rates. To adapt to this condition, the SO team experimented with various methods of data visualization, including soliciting feedback from the women on which visuals worked and which did not. They also combined computer visualization with low-tech but effective methods like large posters.

37. World Bank Social Observatory Website, Video, "The SO—What We Do."
38. Ho & McCall 2016, pp. 20.

Figure 3: Data visualization in Indian villages

Source: Presentation by Vijayendra Rao, "The Social Observatory," Conference on the Delivery of Public Services, World Bank Malaysia Office, 2017.

Extensions

Moving forward, the SO hopes to extend the pilot in PVP to the entire state of Tamil Nadu, which will involve a massive number of 37 million village residents.[39] Currently, the project reaches over three million households in the poorest areas of the state.[40] The World Bank is also exploring the possibility of replicating the p-tracking method in Sri Lanka.[41]

Even though the SO's projects are conducted in India, SO leader Rao believes that "p-tracking can work perfectly in (deliberative) environments" in America, and "might provide lessons for policymakers here in the U.S. who want to provide low-income folks with a meaningful public voice."[42] He cited the example of Washington D.C., where mayor Anthony Williams worked with the nonprofit community to engage constituents from the city's poorer wards in the public policy process, which helped Williams to build support for his reelection.

Findings and Insights

The experience of the World Bank Social Observatory offers three generalizable insights for public managers.

1. **Governments should collect data relevant to citizen needs.** Governments should aim to collect data that citizens care about. In order to do so, public managers should ask citizens for their perspectives, instead of making assumptions. Particularly in the U.S. and other developed nations, local leaders and public managers can harness an already well-established deliberative apparatus to solicit feedback from citizens about what matters to them, and what citizens want to measure and track.

   Collecting data relevant to people, however, requires that analysts embed themselves in local communities for some period of time. In the SO experience, this entailed observing local deliberations, listening to people, and having participants design their own surveys—in other words, thick data informed the collection of survey data. Onno Ruhl, India country director at the World Bank, stresses that an essential condition for the SO's success is a team of young researchers "who are not afraid of getting their sandals dirty."[43]

2. **Governments should give data back to citizens to aid deliberation and decision making.** After collecting large amounts of data, governments should strive to return data to citizens to inform deliberation and collective decision making. Some U.S. cities already take such measures through open data initiatives. The SO case offers an additional insight: data visualization and sharing should not be limited to only wealthy, educated communities. The case demonstrates the benefits of sharing data even with rural and mostly illiterate village women, by using graphics and a combination of high-tech and low-tech methods. This could motivate the expansion of open data initiatives among low-income communities in the U.S. and other countries.

39. Interview with Rao
40. World Bank Social Observatory Website, "Pudhu Vaazhuv." http://socialobservatory.worldbank.org/projects/pudhu-vaazhvu-tamil-nadu-livelihood
41. Interview with Rao
42. Vijayendra Rao, "Deliberation and Poverty: Lessons from the Indian Experience," Spotlight on Poverty & Opportunity, September 6, 2011.
43. World Bank Social Observatory Website, Video, "The SO—What We Do."

3. **The hardest problem is not technology—it's the politics.** Rao cautions against obsessing with "techniques, cool stuff, and dashboards." Even in collecting big data, he advises, it's best to keep technology simple, "otherwise you can't take it to scale." In India, despite the low literacy and education levels, introducing tablets to community mobilizers and local women proved "surprisingly easy," as Palaniswamy relates. At first, the trainers worried that the women may drop the tablets, but in fact they quickly learned to use them. The older women, in particular, who regarded technology as "doing what young people are doing," took special pride in their new skills.

   Rather than technology, public managers should focus most on the social and political infrastructure. Rao cites various examples: Will the government listen? Will village meetings have teeth? Who will have control over funds? Can decisions be implemented? The SO successfully pushed through its pilot by working within the existing socio-political infrastructure—such as with pre-existing women's SHGs—and by partnering with state actors at many levels.

CASE B: APHIS OUTREACH PROGRAM

> *Even with big data, working side by side with agency experts and decision makers to plan the research, interpret findings, and actually use the research to make decisions is and always has been the best way that research and data can improve business or government outcomes.*
>
> —Researchers at **Fors Marsh Group**[44]

From villages in India and the offices of the World Bank, this analysis turns to a case in the U.S. federal government—APHIS (Animal and Plant Health Inspection Service), a division of the U.S. Department of Agriculture (USDA). The APHIS case illustrates the combined use of big data and thick data to achieve "tailored communication" in a revamped public education and outreach program.[45]

Background and Motivations

APHIS's mandate is to "protect and promote U.S. agricultural health."[46] This includes defending U.S. crops against the threats of invasive species and plant-based diseases brought into the country by domestic and international travelers.[47] Travelers often bring in invasive species without knowing or caring about its consequences; this audience is relatively "uninterested, unaware, or actively disengaged."[48] To prevent pest introduction, AHPIS had to increase awareness about the threat of invasive species and inform travelers about the permissibility of bringing items into U.S. territory.

44. Griepentrog et al, "Using social marketing and data science," pp. 263.
45. Ibid, pp. 248.
46. Official Website of APHIS. "About APHIS." (Last modified August 3, 2016). https://www.aphis.usda.gov/aphis/banner/aboutaphis
47. "About APHIS."
48. Michelle Jiles, "Oh, I had no idea–Strategies and Outcomes to get the Public to Care, Even When They'd Rather Not," Website of the International Social Marketing Association. Accessed March 1, 2018.

An effective outreach campaign must tailor information and messages to different traveler segments. To accomplish this goal, APHIS contracted for the research of this program with Fors Marsh Group (FMG), a data science company that has partnered with many U.S. government agencies.

Identifying the Problem

Instead of simply delegating the research and program design to a contractor and passively waiting for results, stakeholders at APHIS and data scientists at the contract partner worked together closely throughout the entire problem-solving process, from theory generation, data creation, to interpretation.

The first step of the research process involves theory generation—identifying the problem. As a lead investigator of the project expressed, theory generation entails asking, "What is the research question that we are trying to answer. What is the most parsimonious way to answer it?"[49] The investigator explained that APHIS did not approach the researchers by asking them specifically to use big data. Instead, APHIS articulated the problem for which they needed help. In this case, APHIS needed to find out whom to target in their communication and public education efforts, given the agency's limited resources. Expressed as questions, this translated to: "Where should we be? Who should we be communicating with? What are some of the most prominent items that are likely to be unwittingly or wittingly brought into the country?"[50]

Once the agency had articulated its problem, the data scientists' formulated research questions and subsequently recommended appropriate response methods. This research process is problem-driven, rather than data-driven, and followed "a multimethod approach involving both qualitative and quantitative techniques."[51] Specifically, the researchers applied computational statistical techniques to analyze a dataset of inspections, integrating this approach with interviews of APHIS agents and travelers and cross-sectional surveys of departing travelers.

Finding Big Data

Apart from the first essential step of articulating their agency's problem, APHIS experts also provided valuable "insight into the data sets that we could have at our disposal to create an analytical dataset," Griepentrog related.[52] For the quantitative analysis, data scientists at FMG used the Agricultural Quarantine Inspection Monitoring (AQIM) dataset, provided by APHIS. This dataset records all inspections carried out on travelers entering the U.S. internationally. The data spans a three-year period, from October 2008 to September 2011. In total, it catalogs over a million inspections. The researchers also incorporated data on risks provided by APHIS' Center for Plant Health Science and Technology.

Moreover, instead of taking the dataset's quality at face value, the researchers consulted an APHIS data manager "who understands intimately the rules and relationships that ultimately feed into [the dataset]." The expert's "historical and contextual knowledge" helped the analysts assess the construction and quality of the original data.[53]

49. Unless otherwise indicated, all direct quotes in this case study draw on the author's interview with Brian Griepentrog (May 17, 2018).
50. Interview with Griepentrog.
51. "Using social marketing and data science," pp. 248.
52. Interview with Griepentrog.
53. "Using social marketing and data science," pp. 248.

Analyzing Big Data

After creating and cleaning the dataset, the next step was analysis. To identify the right audience segments for targeting, the researchers conducted a two-step clustering analysis. This identified "homogeneous subgroups of cases in a population"[54]—simply put, it divided travelers into distinct groups with similar attributes. The analysts first generated a tier of clusters by products and sub-clusters by country of origin and point of entry. While human experts may group audiences based on knowledge and intuition, this subjective procedure can introduce errors and is untestable. By contrast, using computational methods can systematically divide the population in the dataset into segments, and generate an objective and verifiable set of predictions.

Converting Results into Program Design

The data scientist's work did not end with producing statistical results. Next, they brought in officials from APHIS to help interpret the results and ultimately use the research to inform concrete aspects of program design. "Several client-provided insights guided prioritization of the segments," the FMG research team reported. For example, taking into account their priorities and budget, APHIS experts indicated that certain animal and plant products and certain pathways should be represented. They also shared their knowledge of agriculture production within the U.S., which helped to determine the risk for key program segments.

The final product of statistical analysis and joint discussion with the experts is shown in Table 2 as a differentiated map of segments of travelers likely to bring prohibited items, either intentionally or unintentionally, into U.S. territory through air, land, or pre-departure pathways.[55]

Instead of relying blindly on the machine, the map resulted from human collaboration that "represented a variety of priorities and stakeholders."[56] Indeed, the researchers insisted on the indispensable value of the "human component":[57]

> With analysis completed, we worked through a challenge inevitable when dealing with data science in the government space—subjective interpretation of the meaning of the results.

54. "Using social marketing and data science," pp. 250.
55. Predeparture refers to entry into the continental U.S. from Hawaii and Puerto Rico.
56. Ibid, pp. 252.
57. Ibid, pp. 251.

Table 2: Audience Segmentation in the APHIS Project

Site	Segment Description	Pathway
Animal Products		
San Francisco	People traveling for family visits, tourism, and business from China with beef and poultry	Air
Miami	People traveling for family visits from South America (Colombia, Ecuador, and Peru with pork)	Air
San Ysidro	People traveling for any reason from Mexico to California with pork or eggs	Land
Plant Products		
San Ysidro	People traveling for business and family visits from Mexico to California with apples, pears, and citrus	Land
Lihue	People traveling home from Hawaii with apples, pears, citrus, and tropical fruit	Predeparture
Miami	People traveling from Jamaica with tropical fruit	Air

Source: "Using social marketing and data science," pp. 252

Presentation of the results was just as important as the analysis. The research team took particular care in giving APHIS joint ownership of the research process, taking the simple but ingenious step of having their agency clients present the results at a briefing to agency leadership. As Griepentrog explained, the effect was "socializing" their partners so that the agency officers were involved in problem solving, rather than being "told what to do."[58]

Bridging Big Data and Human Expertise

This emphasis on "socialization" was in line with the FMG research team's overarching goal of breaking down the "us vs. them" mentality between data scientists and agency operators on the ground. In Griepentrog's view, "immersion"—a term that thick data collectors and ethnographers commonly use—is important because:

> If you stay on the outside and just provide data, you're creating a natural resistance of them [data scientists] telling us [people on the ground] how to do our jobs. But if you are in the field, on the ground, and functionally immersed, you break down the barrier, your recommendations are more likely to be plain language, and the people you are talking to feel like you know what you're talking about.

58. Interview with Griepentrog.

The quote above highlights an especially important and novel insight: the necessity of bridging big data with human expertise, and of building rapport between data scientists and agency operators. Big data can make it tempting to assume that analytics alone will generate necessary results and obviate the need for human interpretation and "immersion." But the APHIS case demonstrates that data scientists and agency experts can work together in key ways:

- Jointly understand the problem to be solved.
- Identify appropriate data sources, their construction and quality.
- Leverage contextual knowledge to inform the interpretation of results.
- Convert statistical results into concrete program designs that reflect agency priorities.
- Garner internal support by giving clients joint ownership of product.

Product: A Differentiated Campaign

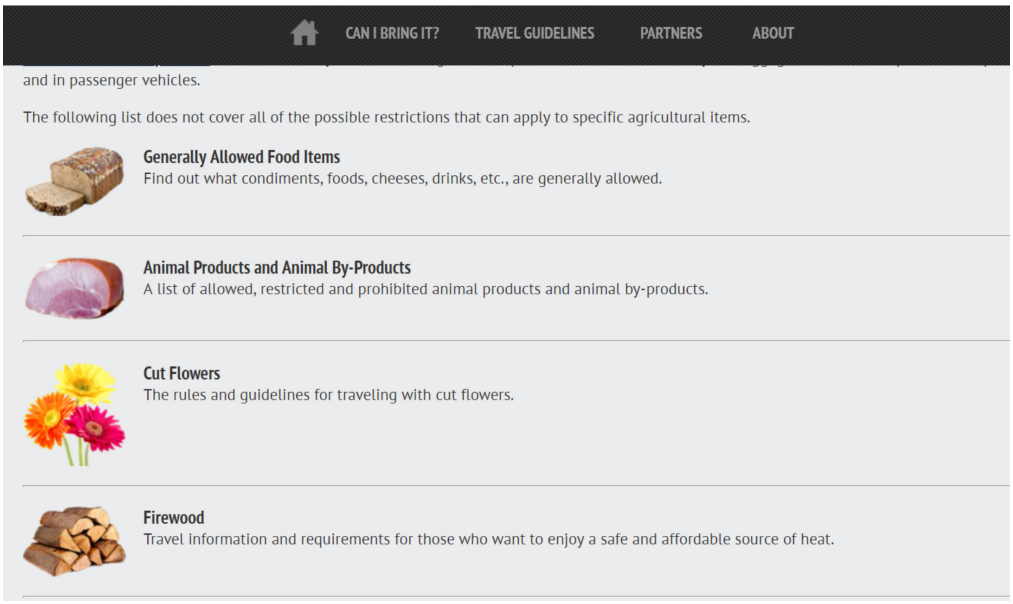
The research ultimately informed and led to a targeted outreach campaign by APHIS, branded as "Don't Pack A Pest," with a dedicated website and an active presence on social media. Empowered by precise information about audience segments, the communication program focuses on the riskiest groups, allocating budgets based on salient segment characteristics (for example, by traveler location) in a cost effective manner.

APHIS could then differentiate messages by geography and by items, with every airport having a different tailored focus and message depending on its most prevalent risks.[59] The research results can also inform the design of the "Don't Pack A Pest" website, which features a user-friendly section on travel guidelines (see Figure 5). In this section, information about regulations and prohibitions is divided by food items (e.g., animal products, cut flowers, fruits, and vegetables) and by country. On the "Can I Bring It?" page (Figure 6), after entering the item they wish to bring in and from which country, travelers receive immediate answers on whether these items are allowed or prohibited.

The federal "Don't Pack a Pest" campaign has also inspired local initiatives. The Oregon Invasive Species Council and Oregon State University's Sea Grant Program have collaborated on an outreach effort that targets international students at the major state universities. Combining social media, brochures, and videos, the initiative informs students about which items they are prohibited from bringing into the United States from their native country.[60]

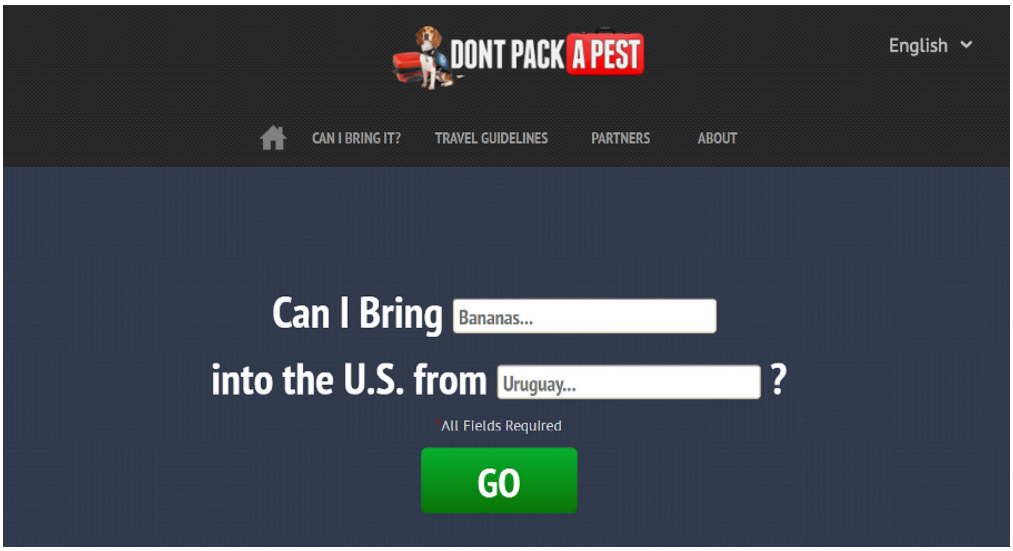
59. Ibid
60. Pokarney, B. *The World*. "Travelers beware, don't pick up invasive hitchhikers." February 18, 2018.

Figure 5: Segmented Travel Guidelines



Source: Website of Don't Pack A Pest

Figure 6: "Can I Bring It?" Query Page



Source: Website of Don't Pack A Pest

Findings and Insights

The APHIS case yields three key lessons for public managers.

1. **Don't blindly feed data and rely on algorithms.** Big data and data analytics can appear to allow organizations to skip the hassle of human interactions. In fact, even with big data, the "human component" is indispensable. As the FMG research team cautioned, "Simply feeding all the information you have available into a program and running a set of scripts or routines on that data is a terribly irresponsible practice, but is becoming increasingly common in our experience."[61]

2. **Not all big data are alike.** No single software solution or statistical model fits all big data sets. Specifically, the APHIS case illustrates the use of a "tall" data set that has a large number of observations (close to a million) relative to the number of predictors. As the researchers point out, "The reality is that agencies much less often have at their disposal data that is truly big, being both tall and fat."[62] But understanding the different shapes of big data matters, because it affects both the modeling choices in statistical analysis and the conclusions drawn.

3. **Data scientists must know the agency's context.** Data scientists must not analyze data in a vacuum, out of touch with the agency's context and needs. Communication and building rapport is central to the job. In particular, Griepentrog stresses the importance of "breaking down the 'us vs. them' mentality" between agency and contractors from the beginning of the process. That is why, he explained, the research team took time and effort to immerse themselves in the work environment of APHIS experts, including by visiting airports and interacting with officers and travelers. In his words, it is essential for the team to "make it clear that you know how important [your client's] work is."[63] The team added, "The analyst team must also become increasingly involved in the operation of the agency and the total set of information available to them."[64] In sum, having big data does not eliminate the need for contextual knowledge—in fact, having thick knowledge of the context is essential for making effective use of big data.

CASE C: LA EXPRESS BANK

> *Ethnography is a strong counterpart to looking at the data and drawing conclusions from it. We can confirm that we're working on the right problem, that we haven't missed something and that our interpretations are correct.*
>
> —**Ken Mihalyov,** Chief Innovation Officer, Xerox Transportation [65]

61. "Using social marketing and data science," pp. 263.
62. Ibid, pp. 247.
63. Interview with Griepentrog.
64. "Using social marketing and data science," pp. 263.
65. Kerschberg, *Forbes,* 2012.

Apart from federal agencies, city governments have also employed big data and thick data to improve services delivery. This third case turns to the LA Express Park, a smart parking system launched in Los Angeles in May 2012. This particular case illustrates the combined use of professional ethnographic research, technology, and real-time big data to improve parking options in congested cities.

Background and Motivations

The LA Express Park represents one component of the Los Angeles Congestion Reduction Demonstration, a citywide plan to reduce traffic congestion. Created with $15 million in grants from the U.S. Department of Transportation and $3.5 million in city funds, this pilot program covers a 4.5 square mile area in downtown Los Angeles. It was developed by Xerox, which has been in the transportation management business since 2010.[66]

As one of the nation's most densely populated cities,[67] traffic congestion has remained a long-standing problem in Los Angeles, of which parking inefficiency constitutes a major issue. Drivers spent much time trying to find parking spaces, with large areas having few taken spaces and other areas too congested. As much as 30 percent of inner-city traffic resulted from drivers looking for parking.[68]

Smart Parking

The city proposed a smart parking system to address this problem, with demand-based pricing at its core. Traditionally, parking prices were uniform throughout the city. In a demand-based parking system, prices automatically adjust based on real-time occupancy data—meaning spots in high demand will be more expensive, and those in low demand will be cheaper; a similar concept applies to the fluctuating rates of ride-hailing services like Uber.

In the LA case, occupancy data is collected through about 6,000 smart meters installed throughout the pilot site. These meters have sensors that record when a spot is occupied, and transmit the information to a central computer that adjusts prices using an algorithm that targets an average occupancy rate of 70 to 90 percent.

This dynamic pricing system connects to a free smartphone application called Parker, which lets drivers find available spaces and see how much they cost. In addition, drivers can use the app to reserve spots, pay for parking using credit cards, and receive notifications before the meter expires.

Branded as "save time, park smarter," the LA Express Park represents a quintessential case of using technology, real-time data, algorithms, and mobile apps to ease parking constraints. In addition to reducing the number of cars cruising for spots, the pilot also aims to cut air pollution and encourage drivers to choose alternative transportation, such as carpools or bicycles, at times of high parking demand. Enthused, LA City Councilwoman Jan Perry has said, "We're finally becoming the cutting-edge city that we've talked about for years."[69]

66. Ibid.
67. Over 45,000 live downtown, a million work downtown, and 10 million people visit downtown every year (Video, "About LA Express Park," Website of LA Express Park).
68. "Los Angeles cuts downtown congestion with smart parking." *Apolitical.* September 5, 2017.
69. "Downtown LA parking apps streamline the hunt for spaces, allow remote payments," ABC News, May 21, 2012.

Figure 7: Parker app

Source: Website of LA Express Park, "Benefits"

Rapid Ethnography

Even with impressive technology, the design of LA Express Park did not rely only on technology and big data. Behind the scenes, ethnography and thick data played a major role in uncovering unexpected issues that subsequently motivated adjustments and new solutions. In Los Angeles, the ethnographic component of the study was carried out by the Palo Alto Research Center (PARC), owned by Xerox. Providing research services to companies and government agencies, PARC houses a division of big data and ethnography. According to the division's website, ethnography "makes explicit people's tacit behaviors, practices, habits, knowledge, and unmet needs or desires—in various real-world (as opposed to laboratory or other isolated) context."[70]

What makes ethnography necessary in a high-tech environment, where algorithms and big data can presumably run of their own? Ellen Isaacs, who previously worked for PARC, explains, "Ethnography helps in real time by showing that people may be having difficulties with parking meters or the signage. These are real world situations that we as operators can bring to the attention of public officials. This is where ethnography once again reinforces technology."[71]

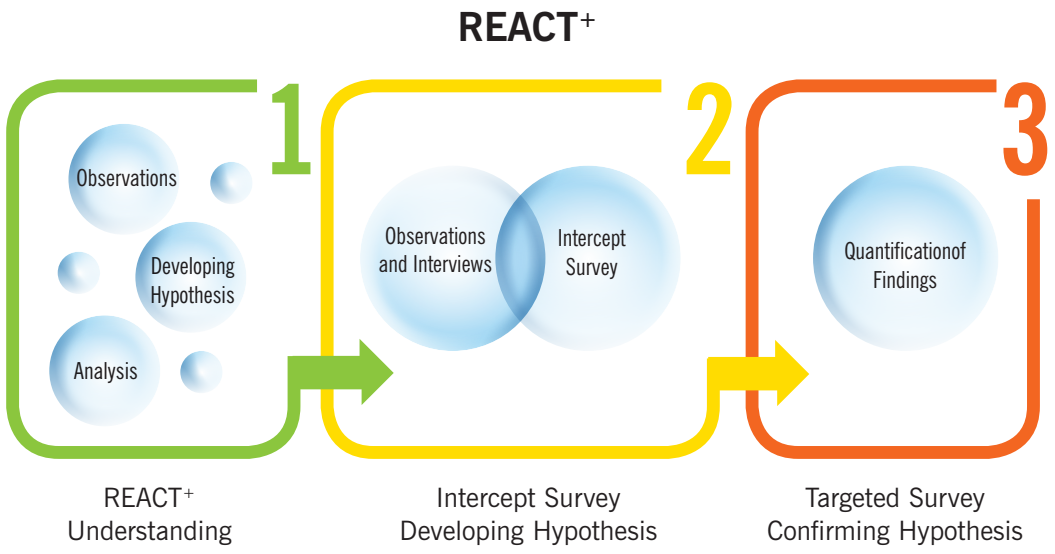
70. Website of PARC, "Competencies," https://www.parc.com/work/competencies.html
71. Quoted in Kerschberg, *Forbes,* 2012

Traditionally, ethnography demands long periods of immersion in one site. In practical responses to time constraints, however, the research center developed a method of compressed ethnography known as REACT (Rapid Ethnographic Assessment and Communication Technique), with two features. First, REACT generates focused findings in a compressed time period, ranging from one to three months. Second, this approach records observations through intensive videotaping, and then communicates findings through engaging video podcasts that clients and stakeholders can view anytime and easily share.[72]

In the case of LA Express Park, the REACT method applied in three steps, summarized in Figure 8. The first step involved understanding. As research ethnographer James Glasnapp describes, this meant "two cycles of the REACT methodology (observation, data collection, and analysis) each lasting six weeks to firmly ground themselves in the customer's point of view." The second step involved verifying observational findings using small-scale intercept surveys. The final phase employed a targeted survey for confirming hypotheses and quantifying findings, culminating in a set of recommendations.

Using the REACT method, researchers conducted ethnographic studies in 2013, after the launch of LA Express Park, to understand drivers' awareness of reactions to the technology of demand-based pricing. They began with two cycles of on-site observations and interviews, each lasting six weeks, "to firmly ground themselves in the customer's point of view."[73] Simultaneously, they did an intercept, a face-to-face survey with 73 people, paired with an online survey.

Figure 8: Three steps in the REACT method



Source: Glasnapp (2013), "The Camera Doesn't Lie"

72. Cummins, D., & Isaacs, E. "The Power of Observation." Website of the International Parking Institute. February 29, 2013.
73. James Glasnapp. (2013). "The Camera Doesn't Lie: Rapid Observation to Create Better Customer Experiences," PARC White Paper, 17 December 2013, pp. 7.

How Ethnography Informed Program Design

A primary question guided the investigation: Are drivers taking advantage of dynamic pricing? If no, why not? On the surface, the idea of dynamic pricing makes perfect sense. Nobel-prize winning economist William Vickery once predicted that demand-based pricing will ensure that "there will almost always be space available for those willing to pay the fee."[74] His vision, unrealistic in the past, is now enabled by technology and real-time data.

Yet thick data collected by the PARC ethnographers revealed a different, nuanced reality on the ground. First, the researchers were surprised to find that drivers had difficulty understanding parking signs, as they reported: "Although we had set out to look at parking, we wound up uncovering a problem with the signage."[75] By assuming the position of drivers, instead of regulators, their observations informed concrete recommendations about how to improve the parking signs. "The convention with parking signs is to state what is restricted when, but drivers looking for a spot want to know what they *can do now*...In our podcast, we suggested that parking signs could be redesigned to be *use-centered* rather than *restriction-centered.*"[76]

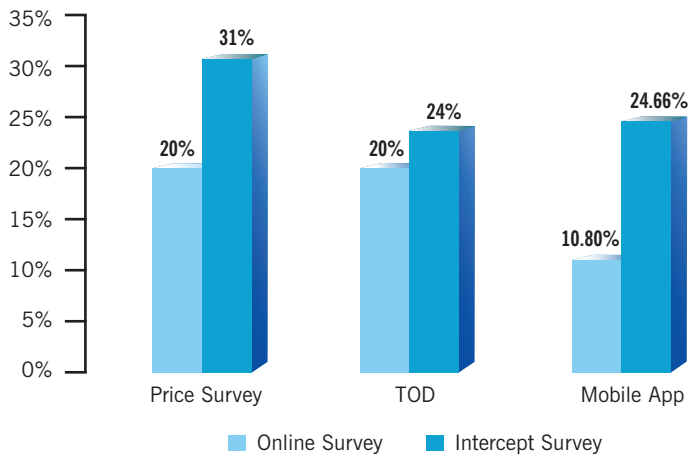
Second, the researchers found that price was not the most important decision factor among drivers. In surveys, it ranked second to proximity, followed by availability of parking spots and time. Third, they also found that many consumers were simply not aware of the existence of dynamic pricing:[77]

> PARC researchers observed that people generally parked and walked away from their meter quickly. When talking to many people while they parked, they were surprised at how unaware people were of the price of parking, that the price of parking may be different across the street or on adjacent streets, or that pricing may change in some locations three times a day.

These observations reinforced surveys (see Figure 9) that indicate low awareness of recent parking price changes, time-of-day (TOD) dynamic pricing for parking in downtown Los Angeles, and mobile applications for smart parking. In 2013, Glasnapp noted, "Very few people were using smartphone applications to assist with finding parking."[78]

74. Glasnapp, Du, et al, "Understanding Dynamic Pricing," pp. 22.
75. Glasnapp & Isaacs, pp. 16.
76. Ibid.
77. Glasnapp, Du, et al, "Understanding Dynamic Pricing."
78. Glasnapp, "The Camera Doesn't Lie," pp. 7.

Figure 9: Survey conducted by PARC ethnographers



Source: Glasnapp (2013), "The Camera Doesn't Lie"

Summing up the situation, Glasnapp wrote:[79]

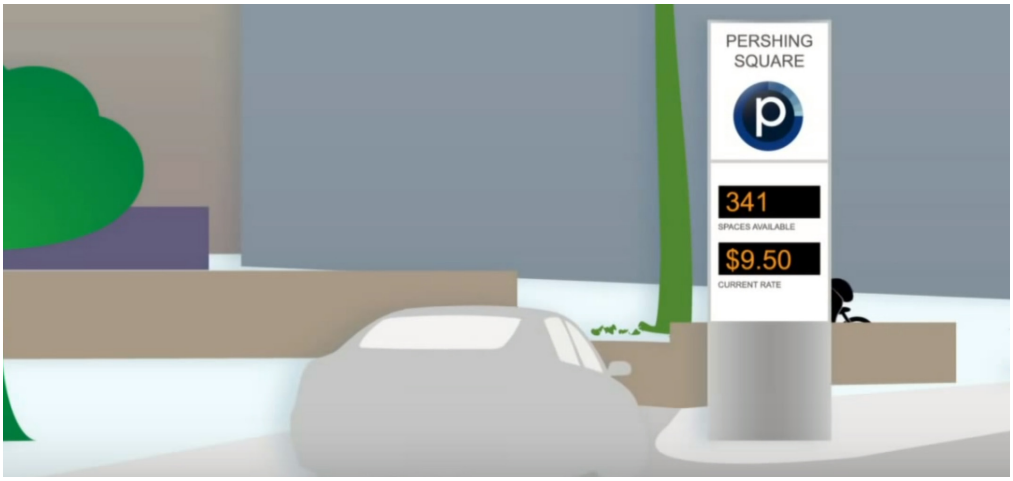
> So why were drivers not taking advantage of the opportunities provided by dynamic pricing? We believe this is due to the fact that drivers' current mode of behavior is to find their destination first and circle for parking with the goal of getting parking as close to that destination as possible. Without awareness of dynamic pricing, and lacking any obvious visual cues during this process, their behavior remained unchanged. One can't deny the stress of looking for parking in a busy metropolitan area, especially when on a tight schedule or in an unfamiliar area.

Apart from problems, the ethnographers also found promising signs that drivers would park in cheaper locations, and as far as three blocks away from their original spot, if they knew of differentiated pricing. Drivers' current practices, however, were to park within one block of their destination. Furthermore, the researchers observed that dynamic pricing appealed more to certain parkers than others—specifically, those who park for long periods of time cared more about pricing than short-stayers. Awareness of dynamic pricing also varied by demographic status; drivers with low education and non-native English speakers knew less about the technology. Collectively, these findings suggest that public education about dynamic pricing can change parking behavior, and that messages should differentiate by groups.

79. Glasnapp, "The Camera Doesn't Lie," pp. 8.

Thick data generated concrete ideas for public communication. In 2013, the adoption of smartphone applications was emerging but generally not yet widespread.[80] PARC researchers suggested the development of an in-car navigation system to guide drivers to parking spots that met driver criteria. The ethnographic studies also noted the need for "obvious visual cues" while driving. Today, LA Express Park features a real-time parking guidance system, using large digital signboards that display information on available parking spaces at select locations. Sensitive to the needs of drivers without access to smartphones, LA Express Park provides alternative means of parking guidance—including 511, a free interactive voice recognition phone system with a website. Last, the FAQ section on LA Express Park's website includes instructions on what drivers should do when smart meters break down. Informed by human observations, all of these features make a new system of parking technology easy to use.

Figure 10: Animation of digital parking signboards



Source: Website of LA Express Park, Video "About LA Express Park"

Using Videos for Communication

In addition to discovering needs, problems, and mechanisms (explanations for why), the RAPID method also features the use of video podcasts for communication. Prior to the launch of LA Express Park, PARC researchers had conducted studies of parking behavior in three other U.S. cities, during which they collected a large amount of visual data. For example, in New Orleans, the research team collected 625 photographs, 49 videos, 14 audio recordings of interviews, and 15 audio notes.[81] Using these materials, they created "self-contained movies, or video podcasts, that tell the story of our findings in a compelling and entertaining way."[82] These video podcasts can easily be shared with clients and stakeholders, and forwarded to others. And rather than read about findings in writing, the videos allow clients to see findings for themselves.

80. As one indication, the number of free mobile app downloads worldwide was 57 billion in 2012; by 2017, it grew almost fivefold to grew to 253 billion. ("Number of free mobile app downloads worldwide," Website of Statistica, https://www.statista.com/statistics).
81. Glasnapp & Isaacs (2011), "No More Circling," pp. 7.
82. Ibid, pp. 3

Extensions

Following its launch in 2012, LA Express Park expanded into Westwood Village in 2014 and Hollywood in 2015.[83] The pilot program claimed measurable successes: 10 percent reduction in congestion, 5 percent reduction in the number of under-utilized space, parking rates decreased by 11 percent even as revenue rose by two percent,[84] and the average meter rate fell from $1.95 per hour before the program to the current $1.76 per hour.[85] Xerox plans to extend the project to other densely populated cities like Denver, New York City, and Washington D.C., which face similar problems of traffic congestion.[86]

Findings and Insights

Echoing the APHIS experience, the LA Express Park case shows that technology and big data do not render the "human component" redundant. Rather, technology performs much better when complemented by human observation and immersion. Three particular lessons emerge:

1. **Apply compressed ethnography for focused problem solving.** LA Express Park illustrates the use of a rapid ethnographic method, which collects thick data within a short timeframe and targets specific problems or priorities, such as how drivers react to dynamic pricing. This compressed strategy addresses clients' need for "results that can be immediately be applied to the design of a budding technology."[87]

   PARC researchers note that the REACT method may not fit all situations, but is most appropriate in situations "where the activity of interest is relatively accessible and somewhat familiar to the researchers, where it is possible to collect and disseminate visual and audio recordings of activities, and where there is a focus on understanding behavior to guide the design or improvement of a product or service."[88]

   LA Express Park fit all of these conditions. Researchers understood parking, such that they could immerse in the situation without learning new jargon or skills; observing and videotaping parking behavior was easy; and the investigation had focused objectives. This contrasts with situations such as medical care where replicating a similar method is difficult—patient privacy is paramount and studying the context requires technical knowledge.

83. Website of LA Express Park, "Frequently Asked Questions."
84. *Apolitical,* 2017.
85. Website of LA Express Park, "Frequently Asked Questions."
86. Korosec, K., "Xerox Built the Ultimate Transportation App for Los Angeles," *Fortune.* January 28, 2016.
87. Glasnapp & Isaacs, "No More Circling," pp. 2.
88. Ibid, pp. 10.

2. **Ethnography complements technology by revealing unknown problems.** Not all problems are obvious. Some problems are not yet noticed or expressed, particularly during the introduction of a new technology. In these instances, humans can identify unexpected problems through immersion and intense observation of particular contexts. In Los Angeles, ethnographers helped uncover "hidden unmet needs"—for instance, drivers' lack of awareness of dynamic pricing and their confusion about parking signs. Once these problems are identified, governments and businesses can then apply technology to solve them.

3. **Thick data can generate ideas and materials for communication.** Intense periods of participant observation can generate useful insights and material for communication. Assuming the position of drivers gave ethnographers the idea of creating public signage for parking spaces and in-car navigation systems. Their observations also led them to differentiate public communication of smart parking by demographic status, as some groups were less aware of the new technology than others. In addition, the rich stock of videos and photographs gathered over the course of research were turned into engaging podcasts for communication with clients.

Part 3
Lessons Learned and Recommendations

Lessons Learned

Although the three cases analyzed in this report differ markedly in location and context, they share similar lessons. Table 3 provides a summary of the cases, and how each case integrates big data and thick data is combined in each of them. Table 4 summarizes four key benefits of a mixed analytics approach: relevance, ownership and empowerment, enhanced communication, and mid-course corrections. The report then discusses six common lessons.

Table 3: Summary of key characteristics of case studies

	World Bank's Social Observatory	APHIS Public Outreach	LA Express Park
Actors and stakeholders	Interdisciplinary team of World Bank researchers, government actors at various levels in India (from leadership of Tamil Nadu down to villages), women's self-help groups	APHIS (agency) and researchers at Fors Marsh Group (contractor)	U.S. Department of Transportation (main funder), Los Angeles City, Xerox-PARC (contractor)
Target users	Rural residents, mostly women	Domestic and international travelers	Motorists
Big data source for quantitative analysis	Pilot census survey of 32,000 residents in Pudhu Vaazhvu, Tamil Nadu	AQIM (Agricultural Quarantine Inspection Monitoring) dataset	Real-time parking occupancy data from 6,000 smart meters
Thick data source for qualitative analysis	Researchers are embedded in communities to observe and listen to deliberations; direct participation by women self-help groups in designing survey	Input from agency experts at all stages of the research process; researchers visited airports and interviewed agency officers and travelers	Rapid ethnographic method (compressed periods of observation, interviews, direct participation, and videotaping)
Product	"P-tracking": survey designed with direct inputs from local women; collected data was visualized and shared with communities to inform deliberation and decision making	Targeted public outreach and social marketing campaign, with messages tailored by location and segment of travelers	Demand-based parking pricing, paired with mobile apps for viewing and booking parking spaces

Source: Yuen Yuen Ang

Table 4: Four Key Benefits of Mixed Analytics

Relevance	Ownership and empowerment	Enhanced communication	Mid-course correction
WB: Thick data motivated the collection of big data that was relevant to local residents. **APHIS:** Thick data helped data scientists interpret the results of big data analysis in the context of agency's priorities. **LA Park:** Thick data identified the priorities of motorists and unexpected problems they faced when using smart parking.	**WB:** Involving residents in the process of survey design and data collection empowered and gave them a personal stake in maintaining good-quality data. **APHIS:** Involving agency experts in the process of interpreting and presenting the results of analysis built rapport and ownership.	**WB:** Data was given back to communities using simple visualizations, designed based on citizens' feedback. **APHIS:** Thick data and big data jointly informed a targeted public communication campaign, differentiated by audience. **LA Park:** Thick data generated rich, multi-media material for communication.	**LA Park:** Initial reception to the initiative was examined on a small scale by an ethnographic team, before rolling out on a larger scale.

Source: Yuen Yuen Ang

Lesson 1

Big data is a means to an end, rather than an end.

The ongoing focus on big data may compel public managers to feel that they need to "do something" with the data, whether or not this is necessary or useful. In the U.S, recent federal plans that link big data to the nation's "strategic assets" may unintentionally reinforce such pressures. But while public agencies should seriously consider big data as part of their toolkit, they should not use big data just for its own sake.

All three case studies illustrate big data as a means to an end, rather than an end in and of itself. This lesson is most explicit in the APHIS case. APHIS did not approach its contract partner with the aim of using big data. Instead, the agency articulated a goal of creating a targeted social marketing campaign. Based on this goal, the partner then recommended a mixed research strategy that involved big data. This case demonstrates how research and program design processes should focus on solving problem, rather than being data-driven.

Lesson 2

Thick data can identify unexpected problems or previously unexpressed needs.

Clearly, thick data and ethnography can complement big data analysis—the harder work arises in specifying how. Governments can miss obvious problems if they rely only on big data and analytics, as best illustrated by the case of LA Express Park. Thick data also proves particularly useful for informing the collection of big data, as seen in the World Bank's SO project. If public agencies invest time and effort to collect big data without first inquiring what users care most about, they may measure the wrong things.

Lesson 3

Thick data can inform the analysis of big data.

Thick data also informs the analysis of big data. In the APHIS case, data scientists worked closely with agency experts to understand the construction and quality of the data sets, seeking inputs for the design of statistical models and interpretation of results. The data scientists who worked with APHIS found: "Because these results were to inform the development of a campaign that would not exist in a vacuum but instead would be implemented in a mix of policy, political, and budgetary influences, the final solution could not be determined by the machine-based analysis of the results alone."[89]

Lesson 4

Mixed analytics can offer both scale and depth.

Given the different advantages and functions of big data and thick data, the best research teams and technology designs typically use mixed analytics (big data and thick data) and mixed research methods (quantitative and qualitative). In addition, they feature an interdisciplinary team of specialists, not just data scientists. The World Bank brought in economists, sociologists, behavioral scientists, and information system specialists. Designing LA Express Park involved both engineers and ethnographers.

Lesson 5

Applying technology is a social activity, not an isolated technical task.

Applying technology is often an intensely social activity, not a job that engineers and data scientists perform in isolation. At the World Bank, the SO team mobilized entire Indian villages at all stages of its program, from designing surveys, implementing them, to sharing data with the villagers. At APHIS, data scientists worked closely with agency experts, building rapport with them, incorporating their contextual knowledge into computational analysis, and even inviting officers to present the results to the agency's leaders to instill a sense of ownership.

Hence, public managers should not simply outsource big data initiatives to contractors and expect data scientists to produce desired, automated results within the confines of their office. As this report finds, the best programs have four shared ingredients: close collaboration between clients and analysts, an interdisciplinary approach, some immersion in the research context, and robust user feedback.

Lesson 6

The best solutions are not always high-tech.

Being "smart" does not necessarily entail using the most advanced technology available. Reiterating Lesson 1, public managers should focus on their goals or problems to be solved, and adopt a pragmatic approach that welcomes any mixture of solutions, whether high-tech or low-tech.

89. "Using social marketing and data science," pp. 251.

In the villages of India, the World Bank visualized data using a combination of high-tech (survey data collected and analyzed through computers) and low-tech methods (visualizations printed and displayed on large posters). In Los Angeles, improving smart parking involved a simple step of designing clear parking signs. APHIS used big data and computation analysis, but the end products were easy to use and understand, including a website that lets users check travel guidelines by product and country of origin.

APPLYING MIXED ANALYTICS TO THE FEDERAL DATA STRATEGY INITIATIVE

The current President's Management Agenda (PMA) positions data as a "strategic asset" that can "grow the economy, increase the effectiveness of the Federal Government, facilitate oversight, and promote transparency."[90] The PMA calls for a coordinated data strategy across multiple government agencies. At a roundtable to develop the strategy convened by the Office of Management and Budget (OMB) and the Center for Open Data Enterprise (CODE) in May 2018, several cases of data-driven platforms were highlighted.

One of them is the Police Data Initiative (PDI), a website that provides open data on crime and public safety. To date, 130 law enforcement agencies have participated and posted more than 200 data sets for public access. As PDI describes, "Open data allows community groups, the media, as well as the agency itself to analyze and make use of the data."[91]

This report suggests ways of improving such an initiative. While making data open online enhances transparency, more can be done to make the initiative *relevant*. In the PDI case, the program has lots of data and numbers, but few stories to give data meaning. Following the recommendations in this report, the PDI team could ask: Who are PDI's users? How and why do they use PDI's data? PDI may invite different users, such as NGOs and groups of residents, to explore their data and share what they learn. Currently, PDI hosts a blog, but almost all the blogs are written by or from the perspective of law enforcement authorities. The team could invite users and residents to contribute posts, and even better, to respond to blogs written by the police, and vice versa.

Initiatives like PDI can also bring in ethnographers who work on law enforcement and policing to help identify what issues matter most to citizens and what data citizens want to see. This information will help agencies post relevant data. By partnering with NGOs and academic institutions, public managers may invite an interdisciplinary team of quantitative and qualitative researchers to use the data and share their results on the website and with law enforcement agencies. Through these measures, agencies could engage communities to make data meaningful, both to their program partners and to the public.

Recommendations for Public Managers

Big data and predictive analytics present numerous opportunities for public institutions to innovate and improve public services delivery. As De Souza states in an earlier IBM Center report that introduces the promise of big data, "Big data is a new frontier for the public sector. It has captured the attention of public managers across the globe."

90. "Leveraging government data: how it's making a difference," *Fedscoop,* June 28, 2018.
91. Website of the Police Data Initiative, "An Overview of PDI," Accessed at https://www.policedatainitiative.org/an-overview-of-the-police-data-initiative-pdi/.

But while public managers should harness big data, they should also understand its limitations. By itself, big data is not a panacea, nor does it render the role of humans obsolete. Rather, using big data well requires careful human observation and interpretation by trained professionals.

This report introduces the strategy of mixed analytics—the integration of big data and thick data for designing and delivering public services. Thick data provides an essential supplement for big data. By asking, observing, and immersing, ethnographers gain insights into what users really want and how they consume services.

This report outlines the distinction between big data and thick data, the strengths and limitations of each, and why combining them generates a powerful hybrid tool to inform government decisions through research. Three case studies at the international, federal, and local levels illustrate concrete ways of applying mixed analytics. Taken together, the analysis points to five actionable recommendations for leaders and public managers.

Recommendation 1: Make data and technology relevant to the people who use it.

One common lesson that emerges from the case studies is not to use big data for its own sake. Instead, agencies should seek to make data and technology relevant to users, by combining technology with an "ask, observe, and immerse" approach. Specifically, for any big data initiative, public managers should consider essential questions that include: What problems do citizens care most deeply about? How can we use big data and technology to solve those problems? In the process of designing and implementing an initiative, with whom have we spoken? Who have we observed? Who's doing the asking, observing, and immersing? What have we done with feedback?

Recommendation 2: Leverage thick data at appropriate stages of the problem-solving process.

As earlier introduced in this report, any problem-solving process has four steps: (1) Identify problems that matter to users or stakeholders; (2) Propose solutions to the problems; (3) Test and refine solutions on a small scale; (4) Implement solutions on a large scale. Qualitative research methods and thick data are especially useful for steps 1 and 3. For example, the World Bank SO Project invested considerable time and energy in identifying what matters to villagers on the ground, and what survey questions made sense. As a result, the project delivered benefits relevant to villagers, rather than dictated by outsiders.

The "ask, observe, immerse" approach is also pertinent when testing an initiative before a full launch. In Los Angeles, ethnographers examined initial reactions to smart parking, making observations that allowed program managers to adjust both the design of the technology and public communication strategies. In addition, the team conducted small-scale intercept surveys to explore hypotheses, before rolling out targeted surveys to test them. Instead of "asking, observing, immersing" in an ad-hoc manner, the LA case shows that agencies should be clear about the functions that these qualitative measures serve throughout the four steps of problem solving.

Recommendation 3: Build an interdisciplinary team of quantitative and qualitative experts who work closely with stakeholders.

Big data initiatives should not involve only data scientists, but should also have input from qualitative researchers or ethnographers. Ideally, such an interdisciplinary team should divide their work along the lines of recommendation 2, and it should work closely with stakeholders and clients. Sometimes, an interdisciplinary team could be replaced by a team of researchers with a mixture of quantitative and qualitative skills. The research partner contracted by APHIS, for example, conducted both computational analyses and qualitative interviews, whereas the researchers contracted by Los Angeles had a specialized ethnography team.

Recommendation 4: Combine big and thick data to improve communication.

The combination of big data and thick data is especially useful for improving communication, both public and internal. Ethnography can reveal which messages resonate most with citizens and why. And data scientists who converse with agency experts and observe them in their work environment can appreciate their challenges and goals. The most effective targeted marketing campaigns do not result from the biggest dataset—they come instead from data scientists who know their context and data well. In addition, thick data provides material for communication. For example, the ethnographic team in Los Angeles used video recordings to explain problems and solutions to clients in a visual format that was more engaging and effective than reports.

Recommendation 5: Improve government agencies' knowledge of mixed research methods.

Many governments around the world put a great deal of emphasis on the need for public servants to be "future ready" and data literate, but virtually none perceive the need for literacy in mixed research methods. Using big data well requires contextual knowledge; public managers must understand more than just numbers and analytics. Sometimes agency experts can themselves supply thick data, as seen in the APHIS case. At other times, they may outsource thick data collection to contractors, or partner with academic institutions and NGOs.

Using big data well requires not only numerical literacy, but also contextual literacy. Realizing the promise of big data involves more than just bringing in numerical data and technology. Public agencies should also incorporate the human components of "ask, observe, immerse." And above all, they should always strive to make data not just big, but relevant and meaningful.

ABOUT THE AUTHOR

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YUEN YUEN ANG

One area of Professor Ang's research examines strategies for enabling innovation in the public sector, where big data and technology offers many new possibilities for improving governance. Ang's research employs a mixed methods approach, integrating ethnography, interviewing, quantitative analyses, and most recently, machine learning (automated text analysis). Her own research experience led her to appreciate the importance of applying quantitative and qualitative methods, or big data and thick data, at different stages of problem-solving, in order to achieve both relevant and rigorous insights.

Dr. Ang is the author of an award-winning book, How China Escaped the Poverty Trap (Cornell University Press, 2016), which introduces a new framework for enabling adaptive capacity and innovation—known as "directed improvisation"—illustrated in the context of China's bureaucracy. Building off this book, one of her current projects uses machine learning methods to analyze ambiguous directions in large volumes of policy documents. Apart from her scholarly writing, Ang has written blogs on innovation and organizational reforms for the *Stanford Social Innovation Review, UNDP (United Nations Development Programme) Transformation Blog,* and *OECD Development Matters Blog.*

Ang has briefed and/or consulted corporations, governments, and international agencies, including UNDP on issues relating to innovation and tackling complex challenges in global development. She is also a member of a study group on technology & development at the Center for Global Development, based in Washington DC. A graduate of Colorado College and Stanford University, she was on the faculty of Columbia University's School of International & Public Affairs before joining UM.

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