



**NAVAL
POSTGRADUATE
SCHOOL**

MONTEREY, CALIFORNIA

THESIS

**PROBLEM SOLVING IN HOMELAND SECURITY AND
CREATING POLICY CONDITIONS FOR ENHANCED
CIVIC ENGAGEMENT: AN EXAMINATION OF
CROWDSOURCING MODELS**

by

Raymond Bisogno

June 2017

Thesis Co-Advisors:

Carolyn Halladay
Glen Woodbury

Approved for public release. Distribution is unlimited.

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.				
1. AGENCY USE ONLY <i>(Leave blank)</i>	2. REPORT DATE June 2017	3. REPORT TYPE AND DATES COVERED Master's thesis		
4. TITLE AND SUBTITLE PROBLEM SOLVING IN HOMELAND SECURITY AND CREATING POLICY CONDITIONS FOR ENHANCED CIVIC ENGAGEMENT: AN EXAMINATION OF CROWDSOURCING MODELS			5. FUNDING NUMBERS	
6. AUTHOR(S) Raymond Bisogno				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB number: N/A.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) <p>This thesis examines crowdsourcing experiments and engagement models, the leveraging of technology in these pursuits, and their potential utility for solving problems in the homeland security enterprise. Rather than identifying a gap or seeking to fix something that is "broken," the research evaluates the potential benefits of employing crowdsourcing models in homeland security and its related disciplines. It uses appreciative inquiry to evaluate how existing successful models might open new pathways between government and citizens for the generation of knowledge, the exchange of information, or for innovation in approaches to problem solving.</p> <p>This thesis advances the hypothesis that, within the body of crowdsourcing and engagement models, a combination of ideas, examples, approaches, and successes exists that demonstrates potential utility for the homeland security field. The research findings exhibited this potential, manifesting in new partnerships and the creation of new knowledge. Participants, aided only by personal technology, self-organized some initiatives; in other cases, participants simply needed a platform to enable their motivation to contribute. These platforms for engagement and pathways to them were a consistent part of the narrative across the literature. Contributions by the non-professional was also a consistent theme, as was a need for a balanced approach that provides a safe framework within which to operate.</p>				
14. SUBJECT TERMS crowdsourcing, civic engagement, pathways, platforms, problem solving			15. NUMBER OF PAGES 89	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU	

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release. Distribution is unlimited.

**PROBLEM SOLVING IN HOMELAND SECURITY AND CREATING POLICY
CONDITIONS FOR ENHANCED CIVIC ENGAGEMENT: AN EXAMINATION
OF CROWDSOURCING MODELS**

Raymond Bisogno
Senior Policy Advisor, Office of the Deputy Superintendent of Homeland Security,
New Jersey State Police
B.S., Rutgers University, 2006

Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF ARTS IN SECURITY STUDIES
(HOMELAND SECURITY AND DEFENSE)**

from the

**NAVAL POSTGRADUATE SCHOOL
June 2017**

Approved by: Carolyn Halladay
Thesis Co-Advisor

Glen Woodbury
Thesis Co-Advisor

Erik Dahl
Associate Chair for Instruction
Department of National Security Affairs

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

This thesis examines crowdsourcing experiments and engagement models, the leveraging of technology in these pursuits, and their potential utility for solving problems in the homeland security enterprise. Rather than identifying a gap or seeking to fix something that is “broken,” the research evaluates the potential benefits of employing crowdsourcing models in homeland security and its related disciplines. It uses appreciative inquiry to evaluate how existing successful models might open new pathways between government and citizens for the generation of knowledge, the exchange of information, or for innovation in approaches to problem solving.

This thesis advances the hypothesis that, within the body of crowdsourcing and engagement models, a combination of ideas, examples, approaches, and successes exists that demonstrates potential utility for the homeland security field. The research findings exhibited this potential, manifesting in new partnerships and the creation of new knowledge. Participants, aided only by personal technology, self-organized some initiatives; in other cases, participants simply needed a platform to enable their motivation to contribute. These platforms for engagement and pathways to them were a consistent part of the narrative across the literature. Contributions by the non-professional was also a consistent theme, as was a need for a balanced approach that provides a safe framework within which to operate.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	PROBLEM STATEMENT	1
B.	RESEARCH QUESTION	2
C.	LITERATURE REVIEW: ENGAGING CITIZENS.....	2
	1. Overview of Engagement and Crowdsourcing: Social Perspectives	3
	2. Engagement and Crowdsourcing: Governing Perspectives.....	6
	3. Engagement and Crowdsourcing: Incentives, Education, Resilience, and the Web.....	8
	4. Conclusion	11
D.	HYPOTHESIS AND ASSUMPTIONS.....	11
E.	RESEARCH DESIGN/METHODOLOGY	13
F.	CHAPTER OUTLINE.....	14
II.	CROWDSOURCING IN PRACTICE: GEOPOLITICS, SCIENCE AND TECHNOLOGY, AND THE HUMANITIES	15
A.	CROWDSOURCING WITH BALLOONS.....	15
B.	CROWDSOURCING FOR FORECASTING GEOPOLITICAL EVENTS.....	16
C.	CROWDSOURCING IN THE SCIENCES	18
D.	CROWDSOURCING FOR MUSEUMS	20
E.	HACKATHONS FOR CROWDSOURCING	21
F.	CROWDSOURCING FOR RESEARCH.....	23
G.	CROWDSOURCING IN SPACE EXPLORATION.....	24
H.	GEOGRAPHIC INFORMATION SYSTEMS AND THE CROWD.....	27
I.	ANALYSIS	28
J.	CONCLUSION	29
III.	CROWDSOURCING IN THE HOMELAND SECURITY ENTERPRISE: THE ROLE OF SOCIAL MEDIA, EMERGENCY RESPONSE, AND VALIDATION.....	31
A.	AN ALTERNATE VIEW OF CROWDSOURCING: POTENTIAL PROBLEMS.....	31
B.	CROWDSOURCING WITH FEMA	33
C.	CROWDSOURCING IN POST-EARTHQUAKE HAITI	35
D.	ANALYSIS	37
E.	CONCLUSION	38

IV.	CONSIDERATIONS FOR IMPLEMENTATION	39
A.	COGNITIVE SURPLUS	39
B.	UNDERSTANDING MOTIVATIONS.....	41
	1. Means, Motive, and Opportunity	42
	2. Filters	42
	3. Divergent versus Convergent Thinking	43
C.	LEVERAGING WEB 2.0.....	44
D.	SERVING THE CITIZEN CUSTOMER.....	46
E.	MORE ON THE BUSINESS MODEL	47
F.	PATHWAYS AND PLATFORMS.....	48
G.	ANALYSIS	51
H.	CONCLUSION	52
V.	DISCUSSION, RECOMMENDATIONS, AND CONCLUSION	53
A.	PATHWAYS AND PLATFORMS RESTATED	53
B.	FROM RECOGNITION TO HARNESSING.....	54
C.	RECOMMENDATIONS.....	55
D.	CONCLUSION	57
	LIST OF REFERENCES	59
	INITIAL DISTRIBUTION LIST	67

LIST OF FIGURES

Figure 1.	Core Values for the Practice of Public Participation	22
-----------	--	----

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

CERT	Community Emergency Response Teams
DARPA	Defense Advanced Research Projects Agency
DHS	Department of Homeland Security
FEMA	Federal Emergency Management Agency
GIS	Geographic Information Systems
GJP	Good Judgement Project (IARPA)
HSE	homeland security enterprise
IARPA	Intelligence Advanced Research Projects Activity
MIT	Massachusetts Institute of Technology
NASA	National Aeronautics and Space Administration
NPS	Naval Postgraduate School
NWS	National Weather Service
QHSR	Quadrennial Homeland Security Review
RRAP	Regional Resiliency Assessment Program (DHS)

THIS PAGE INTENTIONALLY LEFT BLANK

EXECUTIVE SUMMARY

This thesis begins with the premise that the world has become a more dangerous and complicated place due to the spread of terrorism, increasingly damaging weather events, and other threats to national and economic security. These threats (in their broadest sense) have become more diffuse, and the challenges the government faces to combat them more complicated. It may not be, at the end of the day, reasonable to expect government to address the entire threat landscape with existing resources alone and leave the public at large essentially unaffected, or perhaps more importantly, uninvolved. The conditions for tapping into citizens' intellectual capacity for problem-solving, however, may not be present. This thesis explored the potential of crowdsourcing for this purpose, examining cases in various disciplines to discover what worked well and what did not. A principal focus of the research was crowdsourcing experiments and engagement models, as well as a strategy for leveraging technology in these pursuits.

This research did not attempt to identify problem areas (what is broken), dysfunctional programs, or reasons for low engagement. It analyzed the potential benefits of employing crowdsourcing models in homeland security and its related disciplines, using appreciative inquiry to evaluate how existing successful models may open new pathways between government and citizens. These pathways can lead to the generation of knowledge, the exchange of information, and innovation in approaches to problem-solving. In essence, this research focused on what is working well and looked for ways to apply those methods to homeland security organizations.

An examination of crowdsourcing models across a range of disciplines indicated that given the right conditions, citizens are willing and able to effect positive change and solve problems. Moreover, citizens are highly effective at contributing to projects in which they are engaged, such as environmental monitoring, the arts, hackathons, and space exploration. A number of potential homeland security applications emerged as well. These included developing core values for public participation to ensure equity and integrity, rapid production of new ideas for a time-sensitive problems, and broad

information collection and reporting in a crisis. In nearly every case, non-professionals needed only the right conditions to be present for them to engage.

What this thesis discovered in the process was connective tissue—ideas for connecting the concepts found across the models examined—to endeavors in homeland security. A key idea discussed in an NPS lecture that also emerged as an observable theme across the research was the notion of viewing government in general as a platform for innovation rather than a mechanism for the provision of services.¹ By understanding a citizen’s motivations to engage, government can begin to design more optimal opportunities for that engagement. By also considering business and customer-service sector models, government can discover new ways to increase knowledge and value creation.

In considering implementation of crowdsourcing and engagement models, organizations should consider ethical, legal, and social issues as they develop programs involving citizen contributors. This thesis advanced several specific recommendations intended to begin forming a framework for crowdsourcing in homeland security. First, convene a multidisciplinary commission under the auspices of FEMA and DHS to further explore and advance the issue. Second, have FEMA and/or DHS select several agencies to host pilot programs for crowdsourcing projects. Third and finally, dedicate inquiry and research to incorporating social science curriculum into homeland security education (or viewing homeland security as a social science) to better understand the human aspects of homeland security endeavors.

This research may help contribute to the discourse and literature by providing a theoretical policy framework that embraces non-traditional approaches to meeting homeland security objectives. It may help open new pathways to civic engagement or create the conditions in which that engagement can thrive.

¹ Rodrigo Nieto-Gomez, “Visualizing Government as a Platform” (lecture, Naval Postgraduate School, Monterey, CA, January 2016).

ACKNOWLEDGMENTS

It is difficult to begin to consider all of the people who made this journey possible for me. It began many years ago with an ardent desire for more knowledge and greater understanding, and may not have come to be without the ceaseless prodding of close friends and colleagues who wouldn't let me continue to defer my ambitions. I credit Lieutenant Colonel Raymond Guidetti, New Jersey State Police (NPS Cohort 0403/0404), for being the first to make me believe I could actually be a candidate for the NPS program; and retired Lieutenant Colonel Christian Schulz, New Jersey State Police (NPS Cohort 1103/1104), for finally pushing me over the edge to apply. You were relentless, and I am in your debt for your belief in my abilities.

Thank you, also, to the commanders and command staff during this time, including (now) Lieutenant Colonel Patrick Callahan for giving me the green light to pursue this, and retired Major Robert Little (CHDS ELP Cohort 1601) for your complete support as I tried to manage the program and my duties in the office. I also owe a special debt of gratitude to Lieutenant Colonel Jeffrey D. Mottley—your continued and unqualified support throughout this entire process enabled me to remain fully committed to the program and explore new initiatives for our organization. You were never afraid to listen to and try new approaches and didn't use tradition as the yardstick by which to measure them, only whether or not they were good for the Division. Finally, I am deeply grateful to New Jersey State Police Superintendent Colonel Rick Fuentes for the endorsement to attend and the privilege to be the organization's first civilian to do so. It was a tremendous honor and a responsibility I assure you I did not take lightly.

To my colleagues and fellow NPS alumni at the New Jersey State Police, I absolutely could not have done this without your support and encouragement. I know my absence often impacted the flow of business, but I am grateful for your help in keeping the wheels turning while I was away (special thanks to Matt Horner and Patty Panaro on this point). To the “crew in the back,” who never failed to check on me and help me keep my sense of humor—Dan Engelhardt, John Sullivan, Mark Finnegan, Pete Mosteller, Chris Cresong, Fritz Fragé, Steve Schenckle, Dean D'Agostino, Jeremy Russ, Tim Coyle

(CHDS Cohort 1301/1302), Betty Stana, Dave Cipriano, Mohamed Telab, and many others—thank you, sincerely, for being in my corner and helping me keep my chin up and my feet on the ground. You guys were truly a lighthouse in a storm.

To the staff and faculty at NPS—whom we all like to think of now as our extended NPS family—your help, advocacy, and patience sustained us during this expedition. Chloe Pica (Chloe!!!), Craig Coon, Jodi Stiles, Heather McColgan, and Greta Marlatt, who led so many of us out of the wilderness and helped us become better researchers, you are all amazing and dedicated professionals who contribute immeasurably to the fabric of the NPS experience, and my time there was so much richer because of you. I'm happy to count you as friends now and hope to for years to come. Other members of “the family” deserve mention here, too: CHDS Cohort 1503/1504 and their OC Scott Martis were gracious hosts when I joined them for their thesis lab in West Virginia, and the members of Cohort 1505/1506 who invited me to their class luau and made me feel right at home with them. You all are a testament to the ethos of this program and I'm genuinely happy our paths crossed. To Mark Pritchard (CDR, USN, Retired), thank you, Skipper, for your advice and support—I enjoyed our talks a great deal. To my writing coach, Noel Yucuis, and my editor, Aileen Houston, your grace and skill in guiding me through the process of drafting a coherent manuscript was remarkable. You're both absolutely wonderful and helped make this an infinitely better project—thank you, sincerely. And of course, a very special thanks to Heather Issvoran, a friend and treasure to countless NPS cohorts and the glue that holds us all together. You are a luminary, my friend—kind and endlessly supportive and enthusiastic, and I don't think any of us could imagine this program without you.

To my advisors, Carolyn Halladay and Glen Woodbury, I am deeply grateful for your patience, advice, and insight as you guided me along this path. I'm certain I'd still be working on my proposal if not for your persistence (endurance, really). Even though it might not *always* have been fun, I did very much enjoy hammering away at this with you, sometimes with sledgehammers, to shape my ideas into a coherent academic work. To you and to *all* the faculty, I say thank you. You taught us a great deal and improved our abilities in many areas, and my classmates and I often discussed the profound sense of

change we were experiencing during this program. You were all incredibly impactful in your own way, and the lessons you imparted continue to reveal themselves as we view our work in the homeland security field through a refocused lens. We were able to shed old ways of thinking, debate for the sake of understanding another point of view rather than to win an argument, and allow ourselves to take academic risks that led to valuable growth. Dr. Bellavita, on day one you told us we weren't going to solve homeland security; we were going to make a contribution to it as a still-evolving field. The year-and-a-half of academic rigor that followed helped us realize that our work in the program was only the beginning of that contribution, and that we still have much to discover and much to learn. I appreciated every moment of—to borrow a line from the movie *A Beautiful Mind*—"cognitive reverie" in your class, and will carry those lessons with me in every endeavor I undertake.

To my classmates: You are as fine an assembly of professionals as I have ever had the privilege of working with, and the friendships and memories we made will last a lifetime. From earnest debates and fellowship in the arduous work we faced together to laughter and cheer in the Trident Room, I simply cannot imagine my life now without the camaraderie we shared. They told us a lot of the learning in this program would take place among and between students, and they were right. To borrow a phrase used by Sir Isaac Newton, "If I have seen further than others, it is by standing upon the shoulders of giants." Good luck and Godspeed in all you do in the world.

To my older brother, Tony: Every boxer needs a good cornerman, and I was lucky to have you as mine. No matter what I was slugging it out with in the ring of life, I always knew you were right there, ready with advice and encouragement and to get me ready for the next round. Thank you, big brother, for everything. To my wonderful sisters, Joanne and Liz, and my beautiful daughter, Carly, and everyone else in my family (including Al and Manny!) who were so incredibly supportive: thank you. You were always there, asking how things were going, nodding politely through my lengthy explanations, and encouraging me to persevere. We were raised with such a strong sense of family, and this experience was so much more meaningful because I had you to share it with. I love you all.

Last, and most importantly, to my beautiful wife, Maria, and our two wonderful daughters, Gabrielle and Stephanie. It's difficult to express just how profound my gratitude is for you being by my side no matter what I've attempted, and no matter how messy the effort has been. I'd imagine there may have been at least ... a couple days ... during this process when I was a bit stressed out and grumpy, but you gave me all the space I needed to work, tough love when necessary, and endless encouragement. The goals I strive for and whatever I accomplish are only possible because of your love and support, and my pride in you propels me to try even harder. And my Maria, with the patience of a saint, you believed in me long before I believed in myself. You have selflessly stood by me through all these years and all of my pursuits, keeping the home fires burning and doing everything you could to help me succeed without so much as a single word of complaint. You listened patiently to my ramblings when I returned home from California, full of new ideas, and encouraged me in between when I was struggling under the weight of the work. You have always picked me up, dusted me off, and kept me going, no matter how discouraged I may have been. Thank you, honey, from the bottom of my heart. I'm nothing without you, my love.

DEDICATION

William Butler Yeats said that education is not the filling of a pail, but the lighting of a fire. This thesis is dedicated to the educators, from grammar school to university, who inspire us to learn, to reach for greater understanding, to question and reason, and explore. Yours is the passion that lights a thousand fires, and for this we are all in your debt.

In this spirit, I've traced the following prose as best as possible to its source. I heard it many years ago from a U.S. Navy physician, Captain J. Smith, MC, when I was working at National Naval Medical Center in Bethesda, Maryland, in the mid-nineties.

Tools of the School

In every point, there is a counterpoint

In every benefit, there is a risk

In every outcome, there is a cost

In every reference, there is a flaw.

The measure of scholarship is knowing,

The counterpoint, the risk, the cost, and the flaw,

The measure of wisdom is judging the balance.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A farmer cannot walk onto a patch of hard-packed dirt, sprinkle seeds on the ground, and expect something to grow. He has to prepare the field, till the soil, consider the environmental conditions, and irrigate the land. Likewise, initiating change in homeland security relies first on creating the conditions for change. This thesis explores crowdsourcing models that have the potential to help solve problems across the homeland security enterprise (HSE) and then considers how policy conditions can help civic engagement flourish.

A. PROBLEM STATEMENT

Much of existing homeland security guidance and strategy is framed in a traditional government-led, centralized approach. A government-to-citizen provision of information and services is not necessarily problematic. For example, when uniformity of guidance or effort is needed, as in a Community Emergency Response Teams (CERT) training program or when there are implications for national security, this model works well. Nevertheless, this centralized approach tends to limit the ways and means by which citizens can participate in homeland security, particularly in terms of helping identify and solve problems. In this sense, the HSE may not be availing itself of a major asset: the intellectual capacity of the American public.

This thesis begins with the idea that the world has become a more dangerous place and that it may not be reasonable to expect government to address the entirety of the threat landscape with existing resources alone. During the research process, connections became apparent between the challenge of large-scale, diffuse problems and the collective capabilities of the public. Literature studied for this thesis also yielded common elements: engagement by non-professionals, the pathways available for such engagement, and the platforms upon which this engagement occurred. To better understand the commonalities among these cases, this thesis considers these connections and commonalities through an appreciative lens, assessing them for utility in the HSE. Notably, several large organizations—the Federal Emergency Management Agency

(FEMA), National Aeronautics and Space Administration (NASA), the Defense Advanced Research Projects Agency (DARPA), museums, and large universities—found merit in employing crowdsourcing models for specific projects.

Surely, community engagement and volunteerism thrives in many locales, and well-established programs, such as AmeriCorps and CERT, provide practical conventions for the civically minded. It may be possible to form new dimensions of engagement that enable interested citizens to contribute on additional planes, including, conceivably, policy development. The Oxford English Dictionary defines crowdsourcing as “the practice of obtaining information or services by soliciting input from a large number of people, typically via the Internet and often without offering compensation.”¹ This characterization of crowdsourcing has a direct bearing on this thesis and direct implications for the HSE. This research explores the formation of new pathways to civic engagement and the possibilities crowdsourcing may hold for the HSE. It also focuses on creating conditions that nurture civic engagement.

B. RESEARCH QUESTION

How can crowdsourcing models help the government’s homeland security enterprise solve problems and create the conditions for enhanced civic engagement? Examining engagement and crowdsourcing models provides new ways for addressing this question and uncovering answers. These models are evaluated for how they may open new pathways between government and citizens to generate knowledge, exchange information, and develop innovative approaches to problem solving.

C. LITERATURE REVIEW: ENGAGING CITIZENS

To begin an examination of crowdsourcing models and citizen engagement, this thesis studied literature on those topics from a variety of perspectives, including business, science, academics, and government. The findings, detailed in this literature review and throughout the thesis, represent a cross-section of those perspectives. The literature review begins with an overview of engagement and crowdsourcing and several factors

¹ *Oxford English Dictionary*, s.v. “Crowdsourcing,” accessed March 21, 2017, <http://www.oed.com/>.

that influence them, and then considers the term “new governance” and its implications for this research. From a social science perspective, the literature review looks at some research on attitudes toward civic engagement (the “relationship between community service and individual perceptions of value”) and the role diversity plays in this context.² From the government perspective, the review considers areas where crowdsourcing and engagement might be well suited, such as participatory budgeting or environmental issues, and then examines some questions of process. The literature review concludes by exploring several Naval Postgraduate School theses, considering incentive-based engagement, civic education, community resilience, and the role of technology in these pursuits.

1. Overview of Engagement and Crowdsourcing: Social Perspectives

The subject of engagement and the factors that influence it has appeared in a great deal of research explored for this thesis. For the purposes of this study, civic engagement is considered in its broadest sense, representing participation in community activities and organizations, including state and federal governmental affairs both political and apolitical. This also includes service in private-sector organizations, boards, panels, or other groups, or volunteerism in any form. During the research process, the literature yielded two recurring themes: formation of new partnerships and creation of new knowledge. Collaborating with non-professionals was a frequent aim, as was creating a balanced approach that provides a safe framework within which to operate. In some cases, participants, aided only by personal technology (i.e., their own electronic devices), self-organized initiatives; in others, they simply needed platforms to enable their motivation to contribute. Often under the label of “new governance,” these platforms for engagement and pathways to them were a consistent part of the narrative across the literature.

² John Hoffman, Julie Wallach, and Eduardo Sanchez, “Community Service Work, Civic Engagement, and Giving Back to Society: Key Factors in Improving Interethnic Relationships and Achieving Connectedness in Ethnically Diverse Communities,” *Australian Social Work* 63, no. 4 (December 2010): 418–430.

The term “new governance” bears on the discussion of crowdsourcing and engagement in this thesis. In an article in the College of William and Mary Law School’s *Scholarship Repository*, Professor James Solomon describes new governance as having to do with the blurring of traditional boundaries, roles, and modes of regulation.³ A political science article by Roderick Arthur William Rhodes characterizes the term as referring to “self-organized, interorganizational networks that complement markets and hierarchies.”⁴ This thesis introduces the concept of new governance to help connect ideas surrounding evolving forms of regulation to ideas and innovations of crowdsourcing.

Crowdsourcing was also a common theme in the literature. Jeff Howe, an author and contributing writer for *Wired* magazine, is generally credited with introducing the term “crowdsourcing.”⁵ He explains in his book that crowdsourcing involves a task traditionally performed by a specialist or small group of specialists but opened up to a broad, often diverse group for accomplishment.⁶ It capitalizes on the knowledge and talents of a much wider body. Four main changes are driving this growing trend, according to Howe: “A renaissance of amateurism; the emergence of the open-source software movement; the increasing availability of the tools of production; and the rise of vibrant, self-organized communities focused around peoples’ shared interests.”⁷ Howe also discusses four main manifestations of crowdsourcing: the use and application of intelligence; the production of mass creative works; the filtering and organizing of vast information stores; and the use of the crowd’s collective pocketbook.⁸

³ Jason M. Solomon, “New Governance, Preemptive Self-regulation, and the Blurring of Boundaries in Regulatory Theory and Practice,” *Wisconsin Law Review* (2010): 591–625, <http://scholarship.law.wm.edu/facpubs/680>.

⁴ R. A. W. Rhodes, “The New Governance: Governing without Government,” *Political Studies* 44, no. 4 (September 1996): 652–667, doi: 10.1111/j.1467-9248.1996.tb01747.x.

⁵ *Oxford English Dictionary*, s.v. “Crowdsourcing,” accessed March 21, 2017, <http://www.oed.com/>.

⁶ Jeff Howe, *Crowdsourcing: Why the Power of the Crowd Is Driving the Future of Business* (1st ed.) (New York: Crown, 2008).

⁷ Jeff Howe, “Crowdsourcing: Why the Power of the Crows Is Driving the Future of Business,” The International Achievement Institute, accessed March 25, 2017, <http://www.bizbriefings.com/Samples/IntInst%20---%20Crowdsourcing.PDF>.

⁸ *Ibid.*

In a 2010 article in *Australian Social Work*, Hoffman, Wallach, and Sanchez hypothesize that there is “a relationship between community service and individual perceptions of value”; their research affirms this relationship.⁹ Hoffman, Wallach, and Sanchez found increases in both the “perception of the importance of community research” and “improvements in attitudes regarding interethnic relationships.”¹⁰ They explain, “When such community service activities are implemented within an ethnically diverse setting (i.e., a higher education institution), reports of a better understanding of members from underrepresented groups emerge.”¹¹ The authors extrapolate that opportunities for collaboration in a community lead to the “discovery of strengths and aptitudes” and the conditions that enable ethnically diverse community members to better understand and engage with each other, and through which ethnic conflict may be reduced. These findings in particular may hold significant potential for application in the HSE as ethnically diverse populations attempt to integrate, and as policymakers and elected leaders strive to meet the needs of their increasingly diverse constituency.

Diversity is also viewed as an important factor in an article by Peter Demediuk of Victoria University in Australia, where he examines community engagement from the perspective of diversity of voice. Demediuk states, “It is widely contended that modern democratic society will only reach its potential when citizens individually and collectively are able to use their knowledge and capabilities to shape their lives through participation (outside election times) in public-sector decision making.”¹² In the small Swedish community he studied for this article, the government has instituted mechanisms for eliciting information from its citizens, actively seeking out issues literally by “going walkabout” to engage with them.¹³ This thought framework corresponds to Demediuk’s argument that “community engagement initiatives assist in tackling current and future

⁹ Hoffman, Wallach, and Sanchez, “Community Service Work.”

¹⁰ Ibid.

¹¹ Ibid., 425.

¹² Peter Demediuk, “Innovative Community Engagement by Local Government: Harnessing Diversity for Voice, Compromise, and Shared Responsibility,” *International Journal of Diversity in Organisations, Communities & Nations* 9, no. 3 (July 2009): 51–65.

¹³ Ibid., 53.

challenges to public management by combining the strengths of citizens, representatives and practitioners.”¹⁴ Demediuk also asserts that “potential benefits include better decision making and accountability, increased social capital, and community strengthening.”¹⁵ In this way, Demediuk explains, members of the public feel more connected and perceive politicians are listening to their concerns.

2. Engagement and Crowdsourcing: Governing Perspectives

The community Demediuk studied for his research also created an interface for the public and government called the “front desk.”¹⁶ This physical location serves as an information resource on any matter a citizen needs; rather than referring the citizen to an appropriate agency, the front desk takes ownership of the issue until it is resolved. This proactive approach to citizen engagement, or new governance, is yielding new information and approaches to issues and life in the community. The community’s leaders are also attempting to adapt these proactive governing principles to engaging with the community’s youth. Demediuk’s research holds significance for the HSE as this thesis considers new pathways to engagement.

In a 2005 article in the *Public Administration Review*, Bingham, Nabatchi, and O’Leary argue that people must be a primary part of the process of governing, and that there are a number of ways that citizens can participate.¹⁷ These include budgeting, public dialogue, dispute resolution, and environmental policy. They go on to explore the concept of new governance, the role of those involved—the stakeholders—as well as models from the local to the international level. Other researchers have cautioned, however, that some citizens may represent a smaller constituency attempting to influence public policy for private purposes.¹⁸ Bingham, Nabatchi, and O’Leary also assert that

¹⁴ Demediuk, “Innovative Community Engagement,” 51.

¹⁵ *Ibid.*, 51.

¹⁶ *Ibid.*, 59.

¹⁷ Lisa Blomgren Bingham, Tina Nabatchi, and Rosemary O’Leary, “The New Governance: Practices and Processes for Stakeholder and Citizen Participation in the Work of Government,” *Public Administration Review* 65, no. 5 (September 2005): 547–558.

¹⁸ Richard C. Box, “Private Lives and Anti-Administration,” *Administrative Theory and Praxis* 23, no. 4 (2001): 541–558.

academia is lagging in this regard when it comes to educating public administrators, laying out research agendas, and calling for curriculum development.

Bingham, Nabatchi, and O’Leary’s research also considers how government may engage with the model of new governance and the role of citizens within it. Topics include choosing processes in which to engage citizens and determining at what point in the process to include them.¹⁹ Additional considerations include the nature of the process (deliberative, consensus-building, interest based, transformative, etc.); equality in representation; impact; and institutionalization of these efforts.²⁰ Bingham, Nabatchi, and O’Leary conclude that demand for new governance trends is “a natural, evolutionary human response to complexity.”²¹ As this thesis considers a wide range of contexts in which information collection, knowledge creation, or problem solving occurs, considerations on the concept of new governance from Bingham, Nabatchi, and O’Leary prove important.

Moving beyond the rationale or benefits of citizen engagement, Harvard University Professor Archon Fung addresses how to implement engagement; examples include legal and policy frameworks and decision-making processes.²² Fung describes some of the ways institutions are designed and the degree to which citizen input is a factor.²³ He then explores participatory design models and evaluates fundamental questions. These questions surround participant selection, communication, authority and power, and legitimacy.²⁴ Professor Fung concludes that some long-held ideas of what citizen participation in democracy should look like may be outdated and no longer suitable for contemporary engagement models.²⁵ Specifically, Fung argues that citizen

¹⁹ Bingham, Nabatchi, and O’Leary, “New Governance,” 554–555.

²⁰ Ibid.

²¹ Ibid., 555.

²² Archon Chung, “Varieties of Participation in Complex Governance,” *Public Administration Review* 66, no. s1 (December 2006): 66–75.

²³ Ibid., 67.

²⁴ Ibid., 67–70.

²⁵ Ibid., 74.

participation supports the principles of legitimacy, justice, and effective public action.²⁶ These principles relate to the ideas of new governance discussed in preceding pages with regard to the role of stakeholders in budgeting, public dialogue, dispute resolution, and policy development. Fung's work also holds implications for the HSE relative to creating new forms of engagement. One facet of engagement that Fung does not address, however, is the question of incentives.

3. Engagement and Crowdsourcing: Incentives, Education, Resilience, and the Web

A 2010 Naval Postgraduate School (NPS) master's thesis by Jason Porter considers an incentive-based approach to homeland security.²⁷ Porter's premise is that national security is too large an enterprise to be managed by the government alone, and the vast resource represented by citizens should be leveraged to meet challenges. Porter contends that citizens assume government will provide for them regardless of their contributions. He concludes that if the status quo were maintained, citizens would remain "free riders" in homeland security, a condition that can only be addressed with the use of incentives. In studying the dynamics of incentives, it may be helpful to explore the motivations and psychology involved in engagement.

An NPS master's thesis by Sydney Hoffman considers the Israeli model of civic engagement and the lens through which that population views involvement in civic activities, as well as their motivations.²⁸ Hoffman's thesis specifically looks at resilience and preparedness, studying the social factors influencing the issue of citizen engagement.²⁹ He found prominent characteristics such as early childhood education on preparedness, the integration of volunteerism into many response agencies, military

²⁶ Chung, "Varieties of Participation," 74.

²⁷ Jason B. Porter, "Energizing the Enterprise: An Incentive-Based Approach to Homeland Security" (master's thesis, Naval Postgraduate School, 2010), i.

²⁸ Sydney S. Hoffman, "Enhanced Resilience through Expanded Community Preparedness in the United States: Application of Israeli Models" (master's thesis, Naval Postgraduate School, 2014), i.

²⁹ The Department of Homeland Security defines resilience as "the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies." Department of Homeland Security, s.v. "Resilience," September 10, 2015, <https://www.dhs.gov/topic/resilience>.

service for much of the population, and citizen-inclusive preparedness exercises.³⁰ The engagement mindset seen in Israel is inculcated from an early age, and widespread citizen participation is accepted as the norm. Consideration of the Israeli model of civic education is applicable to a discussion of engagement and the conditions that might be necessary to cultivate it here in the United States.

In an NPS thesis entitled “Protecting America through Better Civic Education,” Brian Ravert asks how civic education affects homeland security.³¹ He explores how a curriculum in civics may contribute to a sense of national identity for young people and claims that such an education “can enhance their grasp of the concepts of our American representative democracy and ... [teach] the tenets of good citizenship, critical thinking, and the ability to self-govern.”³² Ravert assesses the relevance of *Presidential Directive 8* in a “whole of nation” approach to underpin his argument. Ravert’s thesis confronts a difficult challenge in attempting to frame what can easily be argued an emotional or sentimental issue—the sense of duty or national identity—in a rational, objective, policy-based framework.

NPS master’s student John L. Farrell also writes about community engagement and developing resilience.³³ Farrell argues that the role of the American public in fighting terrorism has not been clearly defined. He reviews four case studies and assesses that despite indications that engagement has a positive impact on safety, the United States has failed to improve homeland security by way of engagement. Farrell recommends bridging the gaps between stakeholders—including citizens—in the homeland security enterprise not only by building on existing efforts but also by developing new forums for collaboration and the exchange of ideas. It is within these forums that Farrell believes solutions to challenges can be developed. Farrell develops a number of criteria and questions related to the development of engagement initiatives. These include building

³⁰ Hoffman, “Enhanced Resilience,” 60.

³¹ Brian P. Ravert, “Protecting America through Better Civic Education” (master’s thesis, Naval Postgraduate School, 2013), i.

³² *Ibid.*, v.

³³ John L. Farrell, “Community Engagement for Collective Resilience: The Rising System,” (master’s thesis, Naval Postgraduate School, 2012), i.

trust, determining what specialties or resources might be needed, and developing methods for countering the terrorist narrative.³⁴ Clearly defining the problem space and carefully constructing questions, as Farrell has done, can be important considerations in developing the conditions for engagement. While exploring the topic of crowdsourcing and engagement more broadly is instructive, specificity with regard to implementation will be required at some point along the continuum, and Farrell's model provides a practical roadmap.

Along the line of implementation, NPS master's student Samuel Rhodes Johnson addresses collaboration and improving situational awareness in the era of Web 2.0 technologies.³⁵ In his thesis, Johnson characterizes Web 2.0 as a "platform without boundaries" and describes how it can "harness collective intelligence [and] treat users as co-developers."³⁶ This characterization has a direct correlation to crowdsourcing for the HSE. Johnson also addresses the challenges of engaging many different parties in emergency preparedness and management. He explains that technological and cultural barriers—such as deficient communications interoperability or lack of information-sharing arrangements—can result in leaders basing operational decisions on incomplete or inaccurate information. This dynamic, Johnson argues, "can lead to inefficient preparedness, response and recovery activities."³⁷ By leveraging Web 2.0 technologies, Johnson claims, FEMA can develop a "culture of collaboration" that may contribute greatly to enhancing outcomes, and submits that these technologies can facilitate thinking and communication among people to solve complex problems.³⁸ He concludes that Web 2.0 technologies can be an agent of change and a way to discover new methods to shape strategy.³⁹

³⁴ Farrell, "Community Engagement," 90–91.

³⁵ Samuel Rhodes Johnson, II, "Improved Web 2.0 Strategy for FEMA to Enable Collaboration and a Shared Situational Awareness across the Whole of Community" (master's thesis, Naval Postgraduate School, 2012), i.

³⁶ *Ibid.*, 14.

³⁷ *Ibid.*, v.

³⁸ *Ibid.*

³⁹ *Ibid.*, 63.

4. Conclusion

The research reviewed yielded several considerations for crowdsourcing and engagement in the homeland security enterprise. Chief among these considerations is that perceptions about the importance of engagement and crowdsourcing are evolving on both supply and demand sides of the equation, and that more contemporary models may be needed for application in the HSE. Also salient was the notion that creating mechanisms for eliciting information from citizens and carefully considering process and implementation have a direct bearing on outcomes. Finding utility for the HSE in crowdsourcing and engagement initiatives will require a broad approach with consideration of not only structure, policy, and implementation, but of social and psychological aspects as well.

D. HYPOTHESIS AND ASSUMPTIONS

This work begins with a set of assumptions that are based on professional experiences in the field of homeland security. These assumptions include that the world has become a more dangerous place due to the spread of terrorism, increasingly damaging weather events, and other threats to national and economic security. Examples of this outlook can be found in the testimony of the Director of the National Counterterrorism Center in a hearing before the Senate Committee on Homeland Security, and the testimony of the Secretary of Homeland Security before the United States House of Representatives.⁴⁰ These threats, in the broadest sense, have become more diffuse, and the challenges the government faces in combatting them more complicated. It may be unreasonable to expect the government to address the entire threat landscape with existing resources alone and leave the public at large essentially unaffected or, perhaps more importantly, uninvolved.

⁴⁰ “Worldwide Threats to the Homeland,” testimony of Matthew G. Olsen, Director, National Counterterrorism Center, before the Senate Committee on Homeland Security, September 17, 2014, https://www.nctc.gov/docs/2014_worldwide_threats_to_the_homeland.pdf; “DHS in Today’s Dangerous World: Examining the Department’s Budget and Readiness to Counter Homeland Threats,” testimony of Jeh C. Johnson, Secretary of the Department of Homeland Security, and Michael McCaul, Chairman of the Committee on Homeland Security, before the United States House of Representatives, Committee on Homeland Security, March 16, 2016, <https://www.hsdl.org/?view&did=795501>.

As homeland security evolves, the enterprise finds itself in a continual state of self-evaluation, doing its best to adapt to shifting threats and challenges. This view is based on professional experience and academic training in the homeland security and emergency management fields, but can also be found in the 2014 Quadrennial Homeland Security Review (QHSR), where the threat of terrorism is further characterized as increasingly decentralized and harder to detect, and natural hazards are said to be more costly and impactful on critical infrastructure.⁴¹ These may take the forms of threats, such as natural disasters or terrorism, or internal difficulties, such as inter-agency communication or policy challenges. Across the spectrum, however, one constant remains: the people the HSE strives to protect. A great deal of the inward-facing public safety effort is designed to safeguard the population, whether citizen or visitor. Nevertheless, can the government create conditions in which citizens have a more active role in their own security?

This thesis hypothesizes that, within the body of crowdsourcing and engagement models, a combination of ideas, examples, approaches and successes exists that demonstrates potential utility for the homeland security field. An assumption is that creating such models and pathways to them will not only create opportunities for interested citizens but also generate new interest. Many of the sources explored in researching this topic focused on successful crowdsourcing experiments, engagement models, and the leveraging of technology in these pursuits, as well as the sources of adverse results.

The focus of this thesis is germane to homeland security because, as noted in the QHSR, threats from terrorism and transnational crime have increased.⁴² The QHSR also portrays an increased breadth of vulnerabilities that are challenging to counter with existing government resources alone. The entirety of the threat landscape described in the QHSR and in testimonies before the Senate Committee on Homeland Security and United States House of Representatives as referenced in the first paragraph of this section—as

⁴¹ Department of Homeland Security (DHS), *Quadrennial Homeland Security Review* (Washington, DC: DHS, June 2014), <https://www.dhs.gov/sites/default/files/publications/2014-qhsr-final-508.pdf>.

⁴² *Ibid.*

well as three decades of military and professional experience—lead to the analysis that it may not be reasonable or sustainable to expect government to address this threat landscape without help from an informed, engaged citizenry.

This research may help contribute to the discourse and literature by providing a theoretical policy framework that embraces non-traditional approaches to meeting identified homeland security objectives, approaches that may not be limited by the boundaries of existing models or policies. The HSE needs to position itself for a new era of threats and challenges, as well as—both literally and figuratively—for a new generation of engaged citizens. This thesis explores how this may be possible.

E. RESEARCH DESIGN/METHODOLOGY

The method used to approach this research is appreciative inquiry, a philosophical framework that does not define outcomes but helps create the conditions for them to emerge.⁴³ Inclusiveness, dialogue, and creativity make it possible for new ideas and approaches to materialize, beginning at a baseline of what is working well and building on that foundation. This thesis uses the appreciative inquiry lens to examine successful crowdsourcing and engagement models across a number of fields to evaluate their potential application to the HSE. Such models could open new pathways between government and citizens to generate knowledge, exchange information, or innovate approaches toward problem solving.

This research does not attempt to identify problem areas (what is broken), dysfunctional programs, or reasons for low engagement. It does not evaluate declining engagement reflected in recruiting levels, membership in civic organizations, or volunteering levels. It does not prescribe compulsory service or define model civic-engagement. Instead, it focuses on what is working and finds ways to apply those methods to organizations in the HSE.

⁴³ Frank J. Barrett and Ronald E. Fry, *Appreciative Inquiry: A Positive Approach to Building Cooperative Capacity* (second printing) (Chagrin Falls, OH: Taos Institute, 2008).

F. CHAPTER OUTLINE

This thesis is organized into five chapters that provide an overview of crowdsourcing, its applications, and some considerations for its use. Chapter II examines crowdsourcing in practice, exploring a range of issues from forecasting geopolitical events to crowdsourcing for the Audubon Society. Chapter III addresses crowdsourcing in public safety and emergency response, studying adverse implications of social media seen in the aftermath of the Boston Marathon bombing, as well as positive cases in post-earthquake Haiti and in storm reporting. Chapter IV considers implementation of crowdsourcing models, contemplating motivations, psychology, different approaches to problem solving, and the ways technology amplifies effort. Chapter IV also views crowdsourcing issues through customer service and business lenses. Finally, Chapter V provides discussion, conclusions, and recommendations.

II. CROWDSOURCING IN PRACTICE: GEOPOLITICS, SCIENCE AND TECHNOLOGY, AND THE HUMANITIES

This chapter examines a range of engagement and crowdsourcing models in part to evaluate their potential for problem solving. This pursuit is not for resolution of any identified problem per se, but rather for the value of developing problem-solving abilities in general. The homeland security enterprise may draw upon these abilities to answer challenges as they emerge, or to develop new innovative approaches to other programs or policies affected by changing circumstances. For the purposes of this thesis, the term “problem solving” includes brainstorming and collecting ideas, information, and data.

History holds numerous mainstream examples of crowdsourcing. From wanted posters for outlaws to neighborhood watch programs, those seeking solutions to problems beyond their sole resolution ability have turned to broader audiences. In more recent history, this dynamic has not only become more progressive with the help of technology but has also exhibited value for engagement. This chapter uses appreciative inquiry to examine a sample of cases wherein crowdsourcing yielded positive outcomes.

A. CROWDSOURCING WITH BALLOONS

The 2009 Defense Advanced Research Projects Agency (DARPA)’s Network Red Balloon Challenge was a seminal event in crowdsourcing.⁴⁴ DARPA, which engages in emerging technology for the purpose of national security, created the challenge to commemorate the fortieth anniversary of the Internet to probe the Web and social media’s capacity for solving broad, time-sensitive problems.⁴⁵ Organizers placed ten large red weather balloons at various locations around the country, and teams from U.S. universities competed for a prize of \$40,000 to be the first to identify the correct location of all ten. A team from the Massachusetts Institute of Technology (MIT) developed a

⁴⁴ John C. Tang et al., “Reflecting on the DARPA Red Balloon Challenge,” *Communications of the ACM* 54, no. 4 (April 2011): 78–85, doi: 10.1145/1924421.1924441.

⁴⁵ “About DARPA,” accessed February 3, 2017, <http://www.darpa.mil/about-us/about-darpa>; “DARPA Network Challenge: We Have a Winner!,” accessed February 4, 2017, <http://archive.darpa.mil/networkchallenge/index.html>.

strategy based on research by Peter Dodds et al. that suggested incentives are a determining factor of success and motivation when employing crowdsourcing to solve distributed search problems. MIT's strategy, therefore, utilized prize money not only for those who found the balloons but also for those who served as intermediaries.⁴⁶ In less than nine hours, the MIT team located all the balloons and won the contest.

The Network Challenge demonstrated the viability of incentivized engagement and the benefit of innovative thinking and new approaches. It yielded potential methods for mobilizing citizens, demonstrated the speed with which this is possible, and suggested promise for other applications of crowdsourcing such as in disaster response or finding missing persons. The challenge's wide geographic dispersion and the multitude of participants all generating and broadcasting reports—some intentionally false to throw other teams off track—also highlighted the importance of validation of information.

B. CROWDSOURCING FOR FORECASTING GEOPOLITICAL EVENTS

The Intelligence Advanced Research Projects Activity (IARPA) is the counterpart to the Pentagon's DARPA. According to IARPA's website, it invests in "high-risk, high-payoff research programs to tackle some of the most difficult challenges of the agencies and disciplines in the Intelligence Community."⁴⁷ IARPA sponsored a competition called the Good Judgement Project (GJP) to explore intelligence matters and the ability of people who are not professional intelligence analysts to forecast global political events. IARPA initially recruited graduate students, faculty, and practitioners from the political science realm.⁴⁸ While a study from the University of Pennsylvania by Lyle Ungar et al. noted that strong forecasters exhibited higher levels of political knowledge and general intelligence, average citizens with modest training in probability and statistics and no access to classified material were able to predict geopolitical events with a success margin as much as thirty percent higher than career intelligence analysts who did have

⁴⁶ Peter S. Dodds, Roby Muhamad, and Duncan J. Watts, "An Experimental Study of Search in Global Social Networks," *Science* 301 (August, 2003): 827–829; Winter Mason and Duncan J. Watts, "Financial incentives and the Performance of Crowds," *Proceedings of the KDD Workshop on Human Computation* (2009): 77–85.

⁴⁷ "About IARPA," accessed February 3, 2017, <https://www.iarpa.gov/index.php/about-iarpa>.

⁴⁸ *Ibid.*

access to classified material.⁴⁹ This uneven performance was not due to extraordinary abilities on the part of citizen-participants, nor was it a reflection of the career analysts' skills; it was an outcome of the laws of probability and statistics. In an April 2014 report on the GJP, National Public Radio (NPR) explains that balancing a wide range of predictions can lead to a more reliable finding "at the center."⁵⁰

Philip Tetlock et al., writing about the GJP for the *Journal of Experimental Psychology: Applied*, assessed forecasts over a two-year period. After more than 150,000 forecasts, 743 participants, 199 events, and two years, they described favorable performance predictors as follows:

The best forecasters ... were better at inductive reasoning, pattern detection, cognitive flexibility, and open-mindedness. They had greater understanding of geopolitics, training in probabilistic reasoning, and opportunities to succeed in cognitively enriched team environments. Last but not least, they viewed forecasting as a skill that required deliberate practice, sustained effort, and constant monitoring of current affairs.⁵¹

In further examining participants' profiles, Tetlock et al. explain that the best forecasters "benefitted from working environments with probability training and collaborative teams. And while making predictions, they spent more time deliberating and updating their forecasts."⁵² Moreover, the predictors of effective forecasting persisted across multiple data sets.⁵³ Some of the participants, based on their forecasting performance, came to be known as super-forecasters.⁵⁴ One such "super" was a gentleman named Nick Hare. He noted that his success as a forecaster did not have as much to do with his own body of

⁴⁹ Lyle Ungar et al., *The Good Judgement Project: A Large Scale Test of Different Methods of Combining Expert Predictions* (AAAI Technical Report FS-12-06) (Palo Alto, CA: Association for the Advancement of Artificial Intelligence, 2012); Alix Spiegel, "So You Think You're Smarter than a CIA Agent," NPR, April 2, 2014, <http://www.npr.org/sections/parallels/2014/04/02/297839429/-so-you-think-youre-smarter-than-a-cia-agent>, accessed 2/4/17.

⁵⁰ Spiegel, "CIA Agent."

⁵¹ Philip Tetlock et al., "The Psychology of Intelligence Analysis: Drivers of Prediction Accuracy in World Politics," *Journal of Experimental Psychology: Applied* 21, no. 1 (2015): 1, doi: 10.1037/xap0000040.

⁵² *Ibid.*, 10.

⁵³ *Ibid.*, 10.

⁵⁴ Mary Pat Campbell, "What I've Learned from the Good Judgement Project," *Forecasting & Futurism Newsletter* 11 (July 2015): 21.

knowledge as it did with his open-minded approach as well as his ability to apply the scientific method in evaluating the data rather than accept a predefined narrative.⁵⁵

As noted by Ungar et al., working in groups greatly improves prediction accuracy.⁵⁶ The question of how to utilize the wisdom of the crowds, this study recognizes, is more difficult to answer than whether or not that wisdom is valuable: “Although the ‘wisdom of the crowds’ and the power of predictive markets are widely recognized, it is less clear how to best make use of that wisdom.”⁵⁷ An important dynamic the study observes is the risk of group-think when experts are able to discuss their predictions. While the study acknowledges the inverse is also possible—that better arguments can be formed this way—this thesis theorizes there may be a risk of group-think in homeland security and government enterprises *unless* outside perspectives are considered due to cultural biases and organizational tendencies. Replicating the GJP in the HSE may represent a viable pathway for the contribution of ideas to help solve the nation’s complicated problems.

C. CROWDSOURCING IN THE SCIENCES

Crowdsourcing for environmental interests is an area that has yielded extensive knowledge. In “Social.Water—A Crowdsourcing Tool for Environmental Data Acquisition,” researchers Michael Fienen from the U.S. Geological Survey and Christopher Lowry from the University at Buffalo explain, “Acquisition of field data is an expensive part of most geoscience projects.”⁵⁸ These efforts also provide researchers the chance to connect to and interface with members of the public. In their project, members of the public, guided by signs posted in various locations on water-level gages, sent text messages to the researchers about the readings. A server sorted information by gage location and then uploaded the data in near-real time to a Web platform. Fienen and

⁵⁵ Campbell, “What I’ve Learned from the Good Judgement Project,” 22.

⁵⁶ Ungar et al., *The Good Judgement Project*.

⁵⁷ *Ibid.*, 37.

⁵⁸ Michael N. Fienen and Christopher S. Lowry, “Social.Water—A Crowdsourcing Tool for Environmental Data Acquisition,” *Computers and Geosciences* 49 (December 2012): 164, doi: 10.1016/j.cageo.2012.06.015.

Lowry report that, during a nine-month period between 2011 and 2012, “nearly 150 measurements from nine locations were submitted by citizens.”⁵⁹ Fienen and Lowry found that these crowdsourced measurements augment field staff assessments “when telemetry or continuous recordings are infeasible.”⁶⁰ As they point out, the project yielded “a sense of ownership by citizens” who discovered the sites and engaged with them.⁶¹ A “crowdhydrology” project also referenced by Fienen and Lowry demonstrates the capacity of citizens with no special training to engage in important scientific research, often yielding valuable information.⁶² Still other programs may seek users who have received special training or those with a “vested interest in the data.”⁶³ The example Fienen and Lowry cite is a University of Wisconsin project for citizen-based water monitoring.

Fienen and Lowry also cite public engagement in environmental initiatives observed as far back as 1900 with the Audubon Society’s Christmas Bird Counts.⁶⁴ At the beginning of the twentieth century, as the fledgling conservation movement was beginning, some scientists were concerned that the annual Christmas Day bird hunt was causing a decline in bird populations. An original officer of the Audubon Society, ornithologist Frank M. Chapman, recommended a new tradition: a bird census instead of a hunt. The tradition began on Christmas Day in 1900. Twenty-five counts, ranging from Toronto to Southern California, registered approximately ninety species combined.⁶⁵ For more than a century, researchers, biologists, and others with interests in conservation have been able to use this data to study the long-term trends in North American bird populations. “The long-term perspective is vital for conservationists,” Audubon explains,

⁵⁹ Fienen and Lowry, “Social.Water,” 164.

⁶⁰ Ibid.

⁶¹ Ibid.

⁶² Ibid., 168.

⁶³ Ibid., 169.

⁶⁴ Ibid; Yolanda F. Wiersma, “Birding 2.0: Citizen Science and Effective Monitoring in the Web 2.0 World,” *Avian Conservation and Ecology* 5, no. 2 (2010), <http://www.ace-eco.org/vol5/iss2/art13/>; “History of the Christmas Bird Count,” Audubon, accessed February 10, 2017, <http://www.audubon.org/history-christmas-bird-count>.

⁶⁵ “History of the Christmas Bird Count,” Audubon.

“to inform strategies to protect birds and their habitat, and help identify environmental issues with implications for people as well.”⁶⁶ This helps scientists understand the effects of climate change on nearly 600 bird species, over half of which are in danger of losing their habitats. This knowledge, in turn, informs regulations on which the U.S. Environmental Protection Agency bases public policy.⁶⁷ Fienen and Lowry close with an important observation:

The proof-of-concept in this work is one contribution toward fuller engagement of the public in providing scientific observations, leveraging new technology but remaining consistent with efforts spanning back over a century to the beginning of the Audubon Society Christmas Bird Count.⁶⁸

The Audubon model’s success can be instructive for the HSE in mobilizing a broad base of support toward a common goal.

D. CROWDSOURCING FOR MUSEUMS

Museums have recognized the value of crowdsourcing as well. In a piece for *Curator: The Museum Journal*, Digital Editor Nancy Proctor provides a historical perspective dating back to the nineteenth century when the telegraph crowdsourced weather reports from across the country in 1856.⁶⁹ The Smithsonian Institution continued this trend during the advent of the national rail system, when they recruited citizen-scientists to submit specimens to Washington, DC, by rail.

Proctor details how museums increased their crowdsourced collections of metadata and participation in museum taxonomies, greatly altering some internal dynamics by giving voice to these contributors. The museums discovered that the “true value of crowdsourcing lies not in the work product per se—cost-savings in acquiring metadata, transcriptions, or specimens from volunteer labor—but rather in the process of

⁶⁶ “History of the Christmas Bird Count,” Audubon.

⁶⁷ Ibid.

⁶⁸ Ibid.

⁶⁹ Nancy Proctor, “Crowdsourcing—An Introduction: From Public Goods to Public Good,” *Curator: The Museum Journal* 56, no. 1 (January 2013): 105–106, doi: 10.1111/cura.12010, as cited in Frank Rives Millikan, “Joseph Henry: Father of Weather Service,” Smithsonian Institution, accessed October 21, 2012, <http://siarchives.si.edu/history/jhp/joseph03.htm>.

engaging audiences in the mission of the museum, library, archive, or research initiative.”⁷⁰ A recurring theme across the literature, the role of the amateur, is acknowledged and highlighted. As is seen in the familiar public institution of the library, patrons and volunteers play a key role.

E. HACKATHONS FOR CROWDSOURCING

“Hackathons” play an important role in creating engagement pathways as well. Primarily, or at least originally, centered on computing technology, these intense brainstorming events convene groups of people to solve a problem or create something innovative. In the movie *Apollo 13*, NASA engineers had to quickly create a device that astronauts in orbit facing a dangerous crisis could replicate.⁷¹ Engineers were essentially locked in a room with the clock ticking and could only use what they knew the astronauts would have available onboard. This may well have been one of the first notable hackathons.

Researchers Peter Johnson and Pamela Robinson from the University of Waterloo and Ryerson University, respectively, explore civic hackathons to assess the implications for procurement policies and civic engagement.⁷² In doing so, Johnson and Robinson review contemporary features of e-government initiatives and the provision of information to the public online. “Open data” factors prominently into the discourse because it represents a new era of potential for citizens to innovate using information from the government as a foundation. The result has been the development of apps, software solutions, and services.⁷³ In this review, civic hackathons are highlighted for their importance and utility in addressing issues of “civic importance.”⁷⁴ Johnson and Robinson detail the history of civic hackathons, including one in Peshawar, Pakistan,

⁷⁰ Proctor, “Crowdsourcing,” 106.

⁷¹ IMDB, s.v. “Apollo 13,” accessed February 11, 2017, <http://www.imdb.com/title/tt0112384/>; David R. Williams, “The Apollo 13 Accident,” NASA, accessed February 11, 2017, <http://nssdc.gsfc.nasa.gov/planetary/lunar/ap13acc.html>.

⁷² Peter Johnson and Pamela Robinson, “Civic Hackathons: Innovation, Procurement, or Civic Engagement?,” *Review of Policy Research* 31, no. 4 (July 2014): 349–357, doi: 10.1111/ropr.12074.

⁷³ *Ibid.*, 350.

⁷⁴ *Ibid.*, 351.

intended to foster technological innovation and create a social forum for those interested in working for the public good. They also discuss a similar event in Santiago, Chile, designed to address health, education, and housing issues. One of the features of these challenges is prize money. While Chapter IV addresses the issue of motivation, even finding that extrinsic motivations like money can diminish efforts, friendly competitions with prize money, versus remuneration, such as those in Pakistan and Chile, also appear to have a constructive role in some engagement initiatives.

In an attempt to map the scope and ability of civic hackathons, the International Association of Public Participation, referenced in Johnson and Robinson's research, established "7 Core Values for Public Participation" (see Figure 1).⁷⁵

- 1. Public participation is based on the belief that those who are affected by a decision have a right to be involved in the decision-making process.**
- 2. Public participation includes the promise that the public's contribution will influence the decision.**
- 3. Public participation promotes sustainable decisions by recognizing and communicating the needs and interests of all participants, including decision makers.**
- 4. Public participation seeks out and facilitates the involvement of those potentially affected by or interested in a decision.**
- 5. Public participation seeks input from participants in designing how they participate.**
- 6. Public participation provides participants with the information they need to participate in a meaningful way.**
- 7. Public participation communicates to participants how their input affected the decision.**

Figure 1. Core Values for the Practice of Public Participation⁷⁶

Johnson and Robinson highlight core value number six as particularly important in developing the relationship between citizens and government. They conclude that, because such civic hackathons are becoming increasingly common, they must be

⁷⁵ Johnson and Robinson, "Civic Hackathon," 353–354.

⁷⁶ Source: Ibid.

carefully designed spaces for interaction, critical thinking, and knowledge creation. As noted by London researchers Gerard Briscoe and Catherine Mulligan, “The greatest potential and value of hackathons is in providing an opportunity for people to meet and collaborate to create new links in the medium to long term, rather than the short term focus of the event.”⁷⁷ This perspective is of central interest to this thesis.

F. CROWDSOURCING FOR RESEARCH

In a paper prepared for 20th ACM Conference on Computer-Supported Cooperative Work and Social Computing in March 2017, Law et al. introduce crowdsourcing as a “nascent tool for streamlining the process of gathering, processing and analyzing research data in many fields. Tasks that were previously conducted by a small team of researchers can now be parallelized and processed by millions of volunteers over the Web, making questions that seemed previously impossible now tractable.”⁷⁸ Law et al. explore two main questions: (1) Under what circumstances is crowdsourcing a feasible, desirable, or useful tool for researchers, and (2) Under what circumstances is crowdsourcing not suitable for research?⁷⁹ They examine researchers’ practices and cultural norms to determine how to reconcile crowdsourcing contributions.

Law et al.’s intention is to investigate “the non-technical aspects of knowledge production” in order to better design crowdsourcing systems for research.⁸⁰ They review a number of citizen-science projects involving large-scale data collection and some of the history of crowdsourcing in the arts and humanities.⁸¹ As has been consistent across a number of sources, Law et al., too, cite economic and psychology research claiming that payment to citizens for such contributions can have a negative impact on the “quantity

⁷⁷ Gerard Briscoe and Catherine Mulligan, “Digital Innovation: The Hackathon Phenomenon” (Working Paper No. 6), Creativeworks London, May 2014, <http://www.creativeworkslondon.org.uk/wp-content/uploads/2013/11/Digital-Innovation-The-Hackathon-Phenomenon1.pdf>.

⁷⁸ Edith Law et al., “Crowdsourcing as a Tool for Research: Implications of Uncertainty,” *CSCW 2017*: 1544, doi: <http://dx.doi.org/10.1145/2998181.2998197>.

⁷⁹ Ibid.

⁸⁰ Ibid.

⁸¹ Ibid., 1545–1546.

and quality of intrinsically motivated contributions.”⁸² Law et al. describe the value of crowdsourcing for research given the right conditions and conclude that, to best arrive at these conditions, designing the right platforms and protocols for decision-making is essential.

G. CROWDSOURCING IN SPACE EXPLORATION

Since the 1950s, scientists have been conducting increasingly detailed searches for signals from outer space.⁸³ The SETI@home project represents the first endeavor to use “large-scale distributed computing power to perform a sensitive search for radio signals from extraterrestrial civilizations.”⁸⁴ Based out of the University of California, Berkeley, scientists are searching for radio signals using a methodology that demands extraordinary processing power. Because of the need for such significant computing power beyond the researchers’ capacity, this project presents an ideal platform for citizen engagement and crowdsourcing of resources.⁸⁵

Observations take place at the National Astronomy and Ionospheric Center in Arecibo, Puerto Rico, using a 305-meter radio telescope. The task of searching for signals is an easily distributed one, and scientists are able to divide data into independent bands that can be analyzed separately. Portions of the sky can be observed independently as well, creating ideal conditions for the work to be widely distributed among members of the public who are willing to donate processing power when their computers are dormant.⁸⁶ Most remarkable about this project is the sheer scale of citizen engagement. Korpela et al. provide a status report that outlines the details of public involvement, cataloging the contributions of nearly two and a half million volunteers.⁸⁷ Korpela et al. conclude by emphasizing the importance of being receptive to the interests of their

⁸² Bruno S. Frey and Reto Jegen, “Motivation Crowding Theory,” *Journal of Economic Surveys* 15, no. 5 (2001): 589–611, doi: 10.1111/1467-6419.00150, as cited in Law et al., “Crowdsourcing.”

⁸³ Eric Korpela et al., “SETI@Home—Massively Distributed Computing For SETI,” *Computing in Science and Engineering* (January/February 2001): 78–83.

⁸⁴ “SETI@home,” accessed February 10, 2017, <https://setiathome.berkeley.edu>.

⁸⁵ Korpela et al., “SETI@Home,” 79.

⁸⁶ *Ibid.*

⁸⁷ *Ibid.*, 82.

volunteer—indeed, their resource—base. Program managers strive to keep these members informed and to share the science involved in the project. The recognition of this important part of the equation, the relationship between public-sector enterprise and its public, underscores the value of nourishing intrinsic motivations.

Advancing along this trajectory, research of crowdsourcing in the sciences leads to NASA. Scientific developments there have contributed to civil applications involving search and rescue, medical devices, aircraft safety, and weather forecasting.⁸⁸ Beginning in October 2013, NASA ran a pilot program to engage the public in the development of new ideas for technological research and product patents. The initiative uses an online platform identified as Marblar, which allows its members to use some of NASA’s technologies as a basis for new ideas.⁸⁹ The pilot was open to anyone that wanted to contribute ideas, which would then be examined by partners from the commercial sector for viability and potential application. Notably, contributors would share in the ownership of ideas successfully adopted for the pursuit of a patent.

The stated goal of NASA’s Marshall Space Flight Center Technology Transfer Office is to reach new audiences—“the global community,” in their words—“to identify transformative commercial products” and to “ensure that technologies developed for missions in exploration and discovery are broadly available to the public.”⁹⁰ This platform compiles and organizes science patents for research labs and enables any member of the public to use these as a basis for a new idea. The NASA website also explains that NASA’s contribution of patents include advanced satellite optics, micro-sensors, and materials and techniques for the shuttle program.⁹¹ NASA has made more than 1,000 patented technologies, software codes, and analysis tools available to the public.⁹²

⁸⁸ “NASA Engages the Public to Discover New Uses for Out-of-this-World Technologies,” October 23, 2013, <https://www.nasa.gov/content/nasa-engages-the-public-to-discover-new-uses-for-out-of-this-world-technologies>.

⁸⁹ See www.marblar.com.

⁹⁰ “NASA Engages the Public.”

⁹¹ *Ibid.*

⁹² *Ibid.*

In 2016, NASA also enlisted the help of college students to design robots for their Mars exploration project. The 7th Annual Robotic Mining Competition allows students to design and build robots capable of maneuvering and excavating simulated Martian terrain.⁹³ This program not only opens a pathway to the sciences for innovative students and provides a resource-rich platform upon which to experiment with their ideas, it enables them to be part of NASA's expedition to explore Mars. And NASA takes these contributions seriously.

Rob Mueller is a senior technologist in the NASA Kennedy Space Center, as well as co-founder and lead judge of the competition. Referring to the value of crowdsourcing, he noted that “while it takes about one year to fully develop a mining robot in a research lab, the Robotic Mining Competition showcases 50 Martian mining prototypes in just one week”; the piece also points out that “advances in Martian mining, including those displayed every year during the competition, have the potential to significantly contribute to our nation's space exploration endeavors.”⁹⁴ NASA also looks toward the future here on Earth when hosting these challenges. “Autonomous robots are becoming more common across industry on Earth and in space; tomorrow's workforce are the students that graduate today,” Mueller said; “This competition trains the students using NASA systems engineering methods, which puts them in a great position to find a good job—and, of course, NASA would like to hire a few of them as well!”⁹⁵ Engaging in such endeavors, especially with students, provides a model for creating pathways and building platforms. This competition also represents an ideal opportunity to apply the appreciative inquiry methodology to search the HSE for opportunities to replicate its success.

⁹³ Amanda Griffin, “Crowdsourcing Robots: College Students Help NASA on its Journey to Mars,” NASA, May 13, 2016, <https://www.nasa.gov/feature/crowdsourcing-robots-college-students-help-nasa-on-its-journey-to-mars>, accessed 2/11/17, last updated 5/16/16.

⁹⁴ Ibid.

⁹⁵ Ibid.

H. GEOGRAPHIC INFORMATION SYSTEMS AND THE CROWD

While crowdsourcing models have demonstrated problem-solving utility, they have also presented the capacity for augmentation of efforts as well. Perhaps far more than other areas, Geographic Information Systems (GIS) represents one of the most broadly applied disciplines of crowdsourced data. Examples abound in the literature and are commonplace in community mapping circles. Widely used community-based mapping projects range from public health issues to parking and traffic, and even the location of public restrooms. While the specifics of some of these projects may or may not have a direct bearing on homeland security issues, the overarching theme does: these are successful, participatory projects, enabled by amateurs, which serve the public good. An editorial in the *Cartographic Journal of the British Cartographic Society* by Kar et al. explores this issue in depth.⁹⁶

Christine Dunn, cited by Kar et al., reports that non-governmental organizations and community organizations began to use public participation in the 1990s to increase involvement and influence in public policy.⁹⁷ Here, again, the role of the non-expert emerges as integral to the viability of these programs. Public Participation GIS (PPGIS) provides a platform that not only empowers users but facilitates the analysis of problems from different perspectives because they are mapped from multiple views.⁹⁸ Kar et al. also highlight crisis mapping in post-earthquake Haiti, discussed in greater detail in Chapter III, as having integrated messaging via cellphones into their geo-locating efforts (so-termed “geovisualization”). Kar et al. assess that this application of cellphone technology was transformative in nature in geography because of the ease of access, simple user-interface, and immediate impact of users’ contributions on the overall effort.

⁹⁶ Bandana Kar et al., “Public Participation GIS and Participatory GIS in the Era of GeoWeb,” *The Cartographic Journal* 53, no. 4 (December 2016): 296–299, doi: 10.1080/00087041.2016.1256963.

⁹⁷ C. E. Dunn, “Participatory GIS—A People’s GIS?,” *Progress in Human Geography* 31, no. 5 (2007): 616–637, as cited in Kar et al., “Public Participation GIS”; Nancy J. Obermeyer, “The Evolution of Public Participation GIS,” *Cartography and Geographic Information Systems* 25, no. 2(1998): 65–66; Renee Sieber, “Public Participation Geographic Information Systems: A Literature Review and Framework,” *Annals of the Association of American Geographers* 96, no. 3(2006): 491–507.

⁹⁸ Kar et al., “Public Participation GIS,” 296.

The Kar et al. report also cites Twitter and other omnipresent mobile applications that facilitated the proliferation of these technologies.

“Citizen science,” a term used in the cartography piece with citations from still more researchers, again underscores the role of the non-expert for sensing, mapping, and reporting for knowledge creation and sharing of content. These participants, as Kar et al. point out, “outnumber experts and presumably are closer to the phenomena they observe.”⁹⁹ Flint, Michigan, represents an example of this point. Residents of that area affected by the water contamination crisis that began in 2014 collaborated with scientists to aid in their efforts.¹⁰⁰

The report by Kar et al. recognizes three underlying questions across many of these technologies: Who is participating, how are they participating, and why are they participating? These will be essential to bear in mind during the examination this thesis undertakes. The major focus of these efforts, as indicated by Kar et al., is to empower citizens to participate. By creating such pathways, this thesis’s assumptions hold, the conditions for engagement will be created.

I. ANALYSIS

The cases reviewed in this chapter highlighted the positive principles of appreciative inquiry.¹⁰¹ Each of the cases in turn, as well as in their collective body of work, demonstrated that, provided the right conditions—an opportunity to engage in a meaningful pursuit, pathways to the opportunity, and a platform upon which to engage—citizens can effect positive change and solve problems. There were intellectual contributions, the broad acquisition of data, and demonstrations of citizens as sensors. An additional finding in the case of crowdsourcing for museums was that, beyond the

⁹⁹ Renee E. Sieber and Mordechai Haklay, “The Epistemology(s) of Volunteered Geographic Information: A Critique,” *Geo: Geography and Environment* 2, no. 2(2015): 122–136, as cited in Kar et al., “Public Participation GIS.”

¹⁰⁰ Cristina Capineri, “The Nature of Volunteered Geographic Information,” in *European Handbook of Crowdsourced Geographic Information*, ed. Cristina Capineri, Muki Haklay, Haosheng Huang, Vyrion Antoniou, Juhani Kettunen, Frank O. Ostermann, and Ross S. Purves, 15–33, (London: Ubiquity Press, 2016), as cited in Kar et al., “Public Participation GIS.”

¹⁰¹ Barrett and Fry, *Appreciative Inquiry*.

immediate benefit of the contribution of effort itself, patron-contributors were engaging more in their mission.

Innovation and knowledge creation emerged as prominent features of the crowdsourcing and engagement models reviewed. What made many of these models successful was the care taken in designing opportunities that opened the door to new ideas, or new approaches, to the democratization of data collection. The combination of these factors demonstrates the problem-solving potential of crowdsourcing and engagement models.

J. CONCLUSION

Over a range of disciplines, this chapter reviewed cases in which organizations created pathways for citizens to contribute to large undertakings. Through enabling conditions—that is, given the appropriate information and technology to contribute—citizens were highly effective in contributing to the goals of the projects they were engaged in, such as environmental monitoring, the arts, hackathons, and space exploration. A number of potential applications to the HSE were present, including the development of core values for the practice of public participation to ensure equity and integrity in the process of engagement; the rapid production of new ideas for a time-sensitive problem; citizens as sensors; and broad information collection and reporting in a crisis.

THIS PAGE INTENTIONALLY LEFT BLANK

III. CROWDSOURCING IN THE HOMELAND SECURITY ENTERPRISE: THE ROLE OF SOCIAL MEDIA, EMERGENCY RESPONSE, AND VALIDATION

This chapter addresses crowdsourcing in public safety and emergency response, studying adverse implications of social media seen in the aftermath of the Boston Marathon bombing, as well as positive cases in post-earthquake Haiti and in storm reporting. It examines a range of scenarios in which information is collected from citizens for a common and urgent purpose.

A. AN ALTERNATE VIEW OF CROWDSOURCING: POTENTIAL PROBLEMS

A well-known incident that demonstrated the cohesion and resilience of a U.S. community—the Boston Marathon bombing in 2013—also demonstrated some unintended negative consequences of crowdsourcing. An article in *Forbes* (online) explores this issue through the lens of a high school sophomore who was wrongly suspected as one of the bombers and became the victim of a “digital witch hunt.”¹⁰² Before authorities had officially identified a suspect, independent websites posted the sophomore’s photo online, and he was subsequently followed by private citizens (not investigators).

A more formal review conducted by Penn State researchers Andrea Tapia, Nicolas LaLone, and Hyun-Woo Kim found more damning consequences of these unchecked, independent citizen actions.¹⁰³ Among Tapia, LaLone, and Kim’s initial findings was that the media failed to question the veracity of information coming from independent parties conducting their own investigations. The media subsequently propagated that information to a national audience in a context that conveyed legitimacy.

¹⁰² Tarun Wadhwa, “Lessons from Crowdsourcing the Boston Bombing Investigation,” *Forbes*, April 22, 2013, <http://www.forbes.com/sites/tarunwadhwa/2013/04/22/lessons-from-crowdsourcing-the-boston-marathon-bombings-investigation/#1416d38312b5>.

¹⁰³ Andrea H. Tapia, Nicolas LaLone, and Hyun-Woo Kim, “Run Amok: Group Crowd Participation in Identifying the Bomb and Bomber from the Boston Marathon Bombing,” *Proceedings of the 11th International ISCRAM Conference* (May 2014): 265–274.

Bystanders and media alike were found to be essentially conducting a parallel investigation to authorities but without any of the training, legal frameworks (constraints), or other critical contextual information with which officials operate.

The article details the actions of several mainstream online groups and the consequences of their actions, characterized as “dangerous and perhaps criminal.”¹⁰⁴ A number of people were wrongly accused of being suspects by groups whose information was not properly vetted or filtered. The series of events began to form what could be described as a “lynch mob,” or at the very least a “witch hunt.”¹⁰⁵ Tapia, LaLone, and Kim also report that “dozens after dozens of notable news agencies, reporters, and investigative journalists, re-tweeted the misinformation thousands of times.”¹⁰⁶ One of the wrongly accused committed suicide during the investigation. When the information from a variety of sources is being collected, validation of that information is important, or even critical as seen in the Boston case. These circumstances create a clear argument for the importance of filters, carefully developed and implemented, so that public participation is not precluded, but rather balanced with the need for a measured approach to potentially sensitive issues.

Monika Büscher and Michael Liegl, researchers from Lancaster University and University of Hamburg in the United Kingdom, consider some of the issues involving the use of social media in emergency response.¹⁰⁷ In examining the issue of citizen engagement in a crisis, Büscher and Liegl catalog a number of concerns surrounding the “curation of crowdsourced information for situational awareness,” including ethical, legal, and social issues; misinformation that can compromise or endanger operations; vigilantism; and tort liability for civil wrongs by volunteers.¹⁰⁸ From this examination, Büscher and Liegl identified the need to adopt a set of practices or norms that might preclude some of the careless and dangerous behaviors seen during the investigation.

¹⁰⁴ Tapia, LaLone, and Kim, “Run Amok,” 266.

¹⁰⁵ *Ibid.*, 271.

¹⁰⁶ *Ibid.*, 271.

¹⁰⁷ Monika Büscher and Michael Liegl, “Connected Communities in Crisis” (ResearchGate pre-print, 2015), https://www.researchgate.net/publication/261708601_Connected_Communities_in_Crises.

¹⁰⁸ *Ibid.*

These include a “code of ethics” and “Twitter commandments” for filtering accurate information from rumor. More broadly, Büscher and Liegl conclude that the consequences of irresponsible behavior during the Boston investigation call for “creative, concerted efforts to develop ethically, legally, and socially ‘virtuous’ practices and technologies.”¹⁰⁹

B. CROWDSOURCING WITH FEMA

FEMA has developed a viable model for crowdsourcing during disaster reporting, adding a dimension of social engagement.¹¹⁰ The initiative, as of the time of this writing, consists of four parts: the FEMA app with Disaster Reporter feature, FEMA’s Social Hub, FEMA LinkedIn, and the U.S. Fire Administration’s Facebook page. The FEMA app leverages a commonly available platform (a smartphone) that has a readily accessible portal of information about activities or issues related to the agency’s mission, or related to the communities the agency serves, e.g., first responders or emergency managers.

FEMA app information is designed to be two-way; it not only pushes information out to users, it also enables (empowers) citizens to contribute information they assess as important and relevant to the issue at hand (such as a disaster or emergency incident). Additionally, FEMA has considered the need for filtering and quality assurance, and has a process in place to review photos submitted by citizens to ensure they are related to disasters and do not cause privacy issues. Finally, FEMA has considered interoperability across other platforms through the use of Application Programming Interface (API). API is a series of common or standard computer protocols that enable an application or program to work easily with other software systems.¹¹¹

For the purposes of this thesis, the term “problem solving” is expanded to include the concept of brainstorming, or collecting numerous ideas (or pieces of information) in an attempt to find those that contribute to a solution. In this vein, an early model of

¹⁰⁹ Büscher and Liegl, “Connected Communities in Crisis.”

¹¹⁰ Shayne Adamski, “Crowdsourcing Disasters and Social Engagement Multiplied,” FEMA, August 2, 2013, <https://www.fema.gov/blog/2013-08-02/crowdsourcing-disasters-and-social-engagement-multiplied>, accessed 1/18/17.

¹¹¹ *TechTerms*, s.v., “API,” accessed February 21, 2017, <http://techterms.com/definition/api>.

crowdsourcing that demonstrates a viable pathway for citizen-contributed problem solving is known as Skywarn.¹¹² Skywarn relies on individuals called “spotters”; spotters take a course run by the National Weather Service’s (NWS) local Weather Forecast Office, and receive a certificate designating them as official spotters. Trained in taking measurements of snow, rain, wind, temperature, and other weather readings, spotters call in these measurements—measurements that become composites of figures found on reports issued by NWS. This cooperative has become an integral part of NWS functions, leveraging public participation in a way that force-multiplies NWS capabilities.

Another demonstration of opening pathways to outside ideas is “Peer-2-Peer: Challenging Extremism,” an initiative developed by the U.S. Department of State and other partners such as the U.S. Department of Homeland Security (DHS) and Facebook.¹¹³ In it, the Department of State and DHS presented a challenge to hundreds of university students from all over the world to develop ways to counter the narratives of violent extremism. An important and multiplying aspect of this challenge was that students focused on their peers, on persuading them to engage in pushing back against hate speech and other negative language or messaging. These student-developed campaigns capitalized on something a typical government bureaucracy might be challenged to replicate: authenticity. The tools and products developed by these students included, according to the website, “mobile apps, cultural activities, videos, campus movements, social campaigns, websites, viral videos, blogs, education tool kits.”¹¹⁴ Incentives played a role here as well, such as scholarships and invitations to Washington, DC, for competition winners to present their projects.

An inherent characteristic of this program, much like the FEMA disaster reporting and NWS weather-spotter initiatives, is that it takes a large, unwieldy, and diffuse challenge (like weather, or the type of speech that could fuel extremism) and turns it back to the public as a challenge to help solve. Implicit in this example is the recognition that

¹¹² “About,” Skywarn, accessed February 21, 2017, <http://skywarn.org/about/>.

¹¹³ “Peer to Peer,” EdVenture Partners, accessed February 21, 2017, <https://edventurepartners.com/peer2peer/>.

¹¹⁴ Ibid.

government alone may not be able to solve the issue, whether because of finite resources, insufficient understanding of the problem, or that a given government agency is simply not in the optimal position to address it.

C. CROWDSOURCING IN POST-EARTHQUAKE HAITI

In the aftermath of the Haiti earthquake, researchers Robert Soden and Leysia Palen described how volunteers mapped areas affected by the earthquake and made the geospatial data widely available.¹¹⁵ Soden and Palen's report goes on to discuss what they characterize as a "much richer value to humanitarian aid work and the long-term development needs of the country."¹¹⁶ From this response, an effort to create, as Soden and Palen term it, "participatory, community mapping" in at-risk regions began to take shape more formally. The authors describe the critical utility of open-use platforms such as "OpenStreetMap" and an offshoot, "Humanitarian OpenStreetMap," in aiding the international relief effort (and the Haitian community) for a year and a half after the earthquake. The earthquake was, as Soden and Palen point out, "a catalyzing event for many volunteer technology communities."¹¹⁷ They detail how groups assembled in an array of locations and settings to put their heads together ("brainstorm") and develop and implement possible solutions.

One of the locations Soden and Palen refer to was Washington, DC in 2009, where people from many different backgrounds met to collaborate on ideas for "civic hacking."¹¹⁸ Soden and Palen's analysis of such gatherings highlight the intersection between technology and humanitarian work. One of the initiatives they underscore in this context is the Ushahidi Haiti Project (UHP), also commonly referred to as simply

¹¹⁵ Robert Soden and Leysia Palen, "From Crowdsourced Mapping to Community Mapping: The Post-earthquake Work of OpenStreetMap Haiti," *Proceedings of the 11th International Conference on the Design of Cooperative Systems* (May 2014), doi: 10.1007/978-3319-06498-7_19.

¹¹⁶ *Ibid*, 1.

¹¹⁷ *Ibid*, 3.

¹¹⁸ "Crisis Commons, and the Challenges of Distributed Disaster Response," *...My Heart's in Accra*, September 2, 2010, <http://www.ethanzuckerman.com/blog/2010/09/02/crisis-commons-and-the-challenges-of-distributed-disaster-response>, as cited in Soden and Palen, "From Crowdsourced Mapping to Community Mapping."

“Ushahidi,” a Swahili word meaning “testimony.”¹¹⁹ In research cited by Soden and Palen and discussed earlier in Chapter III in under Section A, Büscher and Liegl discuss the Ushahidi Haiti Project as “a milestone in in the development of crisis informatics for humanitarian emergency response.”¹²⁰ Büscher and Liegl describe the innovative ways Ushahidi crowdsourcing and mapping information including how to get resources to affected persons. In their research, Büscher and Liegl cite work by Morrow et al. that describes the U.S. Marines and U.S. Department of State’s use of UHP to increase situational awareness and for the deployment of teams to affected areas.¹²¹ The intersecting research pieces highlighted in this section draw attention to the use of technology and crowdsourced information in crises. Soden and Palen’s article renders a comprehensive review of the role crisis mapping played in the wake of the earthquake, the collaboration it enabled, the life-and-death implications (e.g., the cholera outbreak), and the historic precedents it established for crowdsourcing. The important humanitarian work of volunteers, cataloged by Soden and Palen, represented, to paraphrase the authors’ discussion section, value-infused effort in a real-world context.

Soden and Palen’s work is referenced in the *Journal of Strategic Security* as well, in the article “Before and Beyond Anticipatory Intelligence: Assessing the Potential for Crowdsourcing and Intelligence Studies.” In the article, author Alexander Halman from the University of Pittsburg reports that crowdsourced GIS data is leading to better services.¹²² Halman also confronts the issue of validation, an essential consideration in crowdsourcing. Although Halman inspects the issue deeper than this thesis does, his point warrants due attention. Halman contends that skipping the step of validation, of asking appropriate questions, could have dire consequences in the realm of intelligence, and that

¹¹⁹ “About Ushahidi,” accessed February 11, 2017, <https://www.ushahidi.com/about>.

¹²⁰ Büscher and Liegl, “Connected Communities in Crisis.”

¹²¹ Nathan Morrow et al., “Independent Evaluation of the Ushahidi Haiti Project,” (Development Information Systems International, 2011), <http://www.alnap.org/pool/files/1282.pdf>, as cited in Büscher and Liegl, “Connected Communities in Crisis.”

¹²² Alexander Halman, “Before and Beyond Anticipatory Intelligence: Assessing the Potential for Crowdsourcing and Intelligence Studies,” *Journal of Strategic Studies* 8, no. 3 (Fall 2015): 18, doi: 10.5038/1944-0472.83S.1468.

“the realm of public policy and intelligence is riddled with ill-structured problems.”¹²³ Halman continues, citing the work of William Dunn, stating that “we altogether could be formulating the wrong problem.”¹²⁴ Through the use of validation methods, Halman asserts that crowdsourcing may be able to “get us closer to the right question, and then answer it.”¹²⁵ The aim of this thesis is not anticipatory intelligence, but to determine if crowdsourcing models can aid HSE problem solving; and so many of the same conventions apply. Consideration of filters and validation will be important when collecting input from the public, but so, too, will the way in which the questions are constructed in the first place.

D. ANALYSIS

In this chapter, as in Chapter II before it, themes emerged across the cases reviewed. Among these themes, however, were adverse manifestations of crowdsourcing and engagement. During the hunt for suspects in the Boston Marathon bombing case, several innocent people were wrongfully identified as persons of interest and pursued by members of the public. This case demonstrated the consequences of failing to filter and validate information from the crowd. Misinformation can endanger citizens and compromise investigations. Based on these findings, this thesis assesses that filtering and validation would be critically important when applying crowdsourcing models in homeland security in any context involving an investigation or other emergency situation.

The public safety and emergency management cases in this chapter also confirmed that it is viable to apply crowdsourcing and engagement practices in the HSE. This confirmation came in the form of successful cases of weather and disaster reporting and especially in community mapping efforts in the aftermath of the Haiti earthquake.

¹²³ Halman, “Before and Beyond Anticipatory Intelligence,” 21.

¹²⁴ William N. Dunn, “Methods of the Second Type: Coping with the Wilderness of Conventional Policy Analysis,” *Review of Policy Research* 4, no. 7 (1988): 720–737; William N. Dunn, “Using the Method of Context Validation to Mitigate Type III Errors in Environmental Policy Analysis,” in *Knowledge, Power and Participation in Environmental Policy Analysis*, ed. Matthijs Hisschemoller, Rob Hoppe, William N. Dunn, and Jerry R. Ravetz, 417–436 (Piscataway, NJ: Transaction Publishers, 2001).

¹²⁵ William N. Dunn, “Pragmatic Eliminative Induction: Proximal Range and Context Validation in Applied Social Experimentation,” *Philosophica* 2, no. 60 (1997): 75–112; Halman, “Before and Beyond Anticipatory Intelligence,” 22.

Where Chapter II considered crowdsourcing and engagement from the perspectives of science, academics, and government, Chapter III examined them through the lens of crisis response. This thesis draws corollaries between these applications, however, rather than viewing them as mutually exclusive. The role of amateurs and their latent potential to make a contribution to some overall effort revealed itself in nearly all cases reviewed. And in nearly every case these amateurs—or “non-professionals”—needed only the right conditions to be present for them to engage. In equal measure, however, organizations contemplating crowdsourcing and engagement models must consider ethical, legal, and social issues as they develop programs involving citizen contributors.

E. CONCLUSION

Across the examples of this chapter, citizen contributors addressed time-sensitive problems such as developing weather patterns in advance of storms, mapping of damage in the wake of significant events, i.e., the Haiti earthquake, and emergency response. Validation of information emerged as an important consideration, as did consideration of ethical, legal, and social issues. The cases reviewed demonstrated that misinformation can compromise or endanger operations. Disaster reporting showed that common access to a platform for sharing information can be critical in saving lives and allocating resources, a significant factor for the homeland security enterprise.

IV. CONSIDERATIONS FOR IMPLEMENTATION

Part of the premise behind the hypothesis of this thesis—that within the body of crowdsourcing and engagement models there is potential benefit for the homeland security enterprise—is found in the ideas of Clay Shirky’s book *Cognitive Surplus*.¹²⁶ In the introduction, this thesis noted that a great deal of the inward-facing public safety effort is designed to safeguard the population, whether citizen or visitor. This perspective then begs the question: Where do these citizens fit into the process of homeland security? Using Shirky’s study of the transformative potential of citizens engaging with technology, this thesis has explored the connective tissue between citizens’ contributions and the HSE. If the hope is for an engaged citizenry, the conditions—the policy space—must be created for them to engage and make a contribution.

This chapter explores a number of crowdsourcing models and their features to mine them for ideas that could translate to the HSE. Such features and ideas include methods for tapping into the reserve of intellect in the citizenry, citizens’ motivations for contributing, and the psychology behind these motivations. Through this examination, this thesis also considers different approaches to problem solving and how technology amplifies these efforts. Finally, the chapter considers customer service and business models, and how to support innovation.

A. COGNITIVE SURPLUS

In a journal article from *Contemporary Issues in Technology and Teacher Education*, researchers Glen Bull et al. address Shirky’s work in the context of engaging students in non-traditional educational formats, and how the advent of Web 2.0 has facilitated that transaction.¹²⁷ As it relates to this thesis, Shirky’s theory is “that collaborative projects such as Wikipedia demonstrate a previously unexploited collective

¹²⁶ Clay Shirky, *Cognitive Surplus: Creativity and Generosity in a Connected Age* (New York: Penguin, 2010).

¹²⁷ Glen Bull et al., “Connecting Informal and Formal Learning: Experiences in the Age of Participatory Media,” *Contemporary Issues in Technology and Teacher Education* 8, no. 2(2008): 100–107, <http://www.citejournal.org/volume-8/issue-2-08/editorial/connecting-informal-and-formal-learning-experiences-in-the-age-of-participatory-media>; see also: Johnson, “Improved Web 2.0 Strategy,” i.

intelligence can be tapped when the right conditions are established.”¹²⁸ Experiments like the Good Judgment Project and sites like Wikipedia have demonstrated there are reservoirs of ideas among the public at large, which raises secondary questions. These questions surround how to open up pathways to this surplus, how to encourage engagement, and whether or not to incentivize it. Further considerations may be whether to recruit participants or to use a more open-access model. Developing methods for filtering or validating information is also an important consideration.

An article by Shirky in *The Futurist* states, “The sudden bounty of accessible creativity, insight, and knowledge is a public treasure.”¹²⁹ In an attempt to quantify the scale of effort by contributors, Shirky calculates that the time spent editing articles on Wikipedia equates to approximately 100 million hours of human thought.¹³⁰ It is necessary to consider historical context when viewing the issue through the lens of Shirky’s theory. He explains that “the old view” of online activity was that a very small proportion of people were engaged online; the proliferation of technology has inverted that. “Our social media tools aren’t an alternative to real life,” he explains, “they are part of it.”¹³¹ As social media and information-sharing platforms proliferate, the importance of information validation will increase.

As this thesis explores the connective tissue between the contribution of citizens and the HSE, Shirky’s theories are salient. He contends that media represents the connective tissue of society, and is the means by which individuals are aware of everything that is more than an arm’s length from them, from personal events, to the national discourse, to wars overseas.¹³² Once separate realms, the domains of public and private media have coalesced. Shirky explains, “The old choice between one-way public media and two-way public media has now expanded to include a third option: two-way

¹²⁸ Bull et al., “Connecting Informal and Formal Learning.”

¹²⁹ Ibid, 21.

¹³⁰ Clay Shirky, “Tapping the Cognitive Surplus,” *The Futurist* 44, no 6 (November-December 2010): 21.

¹³¹ Shirky, *Cognitive Surplus*, 37.

¹³² Ibid., 54.

media that operates on a scale from private to public.”¹³³ For example, discussions can now occur in the same forums once controlled by broadcasters. In exploring this idea, he acknowledges how some view ubiquitous platforms like Facebook or YouTube as taking advantage of users and the content they generate. Shirky explains the distinction with a question: “What if the contributors are sharing, not creating?” He offers the analogy of people going to a bar not because the beer is cheaper, but because other people are there. It is the experience and the interaction that creates the value for the contributor. It is the atmosphere.¹³⁴

B. UNDERSTANDING MOTIVATIONS

Shirky also addresses the notion of motivation, as has been seen across the literature, dividing it into two categories: “intrinsic” and “extrinsic.” Intrinsic motivation occurs when the action is personally gratifying in and of itself. The old adage that “the work is its own reward” is an example of this sentiment. Conversely, someone who is extrinsically motivated is driven by an external reward such as monetary compensation. According to Shirky, people are more likely to make a meaningful contribution if they are intrinsically motivated, and the introduction of extrinsic motivators may actually diminish the contribution. He asserts, “Increasing extrinsic motivations can crowd out intrinsic ones.”¹³⁵ The creation of pathways to engagement bears earnest consideration. Shirky addresses this: “If you give people a way to act on their desire for autonomy and competence or generosity and sharing, they might take you up on it.”¹³⁶ This thesis advances the notion that a sense of duty can be a powerful intrinsic motivation, a sentiment echoed in Brian Ravert’s work reviewed in Chapter I.

¹³³ Shirky, *Cognitive Surplus*, 55–56.

¹³⁴ *Ibid.*, 57–58.

¹³⁵ *Ibid.*, 72–73.

¹³⁶ *Ibid.*, 95.

1. Means, Motive, and Opportunity

To frame his analysis, Shirky uses the example of a police investigation, in which there are three primary factors: means, motive, and opportunity.¹³⁷ The previous sections discussed the means (media) and the motives (intrinsic versus extrinsic); opportunity completes this triangle. Shirky contends that when a new phenomenon is introduced, “we look for an explanation in the novelty.”¹³⁸ Examples include a new technology in the form of software or hardware, with the assumption that the new technology is a catalyst. Shirky invokes psychologist Daniel Kahneman and the concept of “theory-induced blindness” to help explain the connection between motive and opportunity.¹³⁹ This theory holds that “adherence to a belief about how the world works prevents you from seeing how the world really works.”¹⁴⁰ To illustrate the point, Shirky considers the question, “Why are all these people working for free?” The presumption is that the opposite (working for money) is the norm, so the very fact that they are working for free demands explanation.¹⁴¹ However, the rapid expansion of content generation and free sharing appears to nullify this premise. “The way users behave,” Shirky explains, “is a reaction to the opportunities you give them.”¹⁴² Understanding intrinsic motivations for contributing becomes possible once the bias of theory-induced blindness is accounted for.

2. Filters

Chapter III introduced the concept of filtering to express the importance of validating information collected from a broad audience. The Boston Marathon bombing case detailed in Chapter III illustrates this point. The degree of filtering and validation needed for a given situation may vary based on the group of participants involved and the goals of the project. Because a model that recruits or invites its contributors based on certain characteristics or qualifications may require less filtering than a barrier-free

¹³⁷ Shirky, *Cognitive Surplus*, 28.

¹³⁸ *Ibid.*, 98–99.

¹³⁹ *Ibid.*, 99.

¹⁴⁰ *Ibid.*

¹⁴¹ *Ibid.*

¹⁴² *Ibid.*, 196.

model, it may be more desirable to an agency that is resource limited. However, when resource limitations are not a central issue, or where the broadest collection possible is desired, a barrier-free model for participation may be preferable.

One of the primary themes addressed in this chapter has been understanding motivations, and the DARPA Balloon Challenge discussed in Chapter II examined the use of incentives. However, creating a value proposition must extend beyond individual monetary incentives, especially where intrinsic motivations are concerned. Recognition may help in the public sector, where monetary incentives can create ethical concerns, but what about entire organizations? The Nash Equilibrium may provide a helpful model from which to seek understanding.¹⁴³ In essence, not only is there an incentive to seek mutual benefit, but a disincentive if it is not achieved. The basic examples provided in the *International Encyclopedia of the Social Sciences* describe games wherein two players, each presented with a set of choices, sustain losses by making choices for individual gain, yet realize the net gain when they make the same choice as the other player. If grant funding, for example, were tied to a demonstration of collaboration or allowed participation but a lack thereof reduced prospective funding, it would provide an incentive by way of value proposition to engage with others and a disincentive for not doing so.

3. Divergent versus Convergent Thinking

Divergent thinking is defined as “creative thinking that may follow many lines of thought and tends to generate new and original solutions to problems, in contrast to convergent thinking, where options are considered from within a pre-determined set of choices.”¹⁴⁴ Dr. Art Markman, of the University of Texas, explains some new thinking

¹⁴³ Rajiv Sethi, “Nash Equilibrium,” in *International Encyclopedia of the Social & Behavioral Sciences*, 2nd edition, ed. James D. Wright, 540–542 (Amsterdam: Elsevier, 2015).

¹⁴⁴ *Merriam-Webster*, s.v. “Divergent Thinking,” accessed April 26, 2017, <https://www.merriam-webster.com/medical/divergent%20thinking>; *Merriam-Webster*, s.v. “Convergent Thinking,” accessed April 26, 2017, <https://www.merriam-webster.com/medical/convergent%20thinking>.

on the subject of brainstorming.¹⁴⁵ Divergent thinking allows brainstorming to transcend artificial boundaries in a given problem-solving exercise. The practice of divergent thinking may also hold another benefit: increasing recognition of ill-structured questions. As shown in Halman's work, discussed in Chapter III, such ill-structured questions can potentially lead to solving the wrong problem or missing a different vulnerability altogether. It may present the risk of narrowing one's field of vision to the exclusion of potentially important corollaries or variables.

Markman explains that the traditional basis for brainstorming exercises is founded in psychologist Alex Osborn's work from the 1950s. Markman's assertion, however, is that over time, groups following traditional guidelines develop fewer new ideas because of a sort of group-think that results when their brains begin to process ideas others are offering instead of searching for new ones on their own. The initial idea or, put another way, the opening salvo, can act like a "contaminant," as Markman terms it, affecting all subsequent contributions and lines of thought that follow. The result, ultimately, is a narrower range of options being considered than if participants were to explore ideas individually. Markman's recommendation to overcome this dynamic is to distribute a problem statement ahead of time and ask for several solution options. In this way, individual thought is not contaminated and group-think, which is held at bay until all potential solutions are harvested. Employing this approach in the pursuit of crowdsourced solutions may provide a viable model to adapt to the formation of new ideas in the HSE.

C. LEVERAGING WEB 2.0

In his 2012 master's thesis, Samuel Johnson highlights FEMA's whole-community approach as well as technological and cultural barriers to collaboration.¹⁴⁶ This has a direct bearing on the examination of crowdsourcing models for possible application in the HSE, as FEMA's mission, responsibilities, and priorities are increasingly related to homeland security issues. One of the challenges Johnson notes is

¹⁴⁵ Art Markman, "Why Other People Wreck Brainstorms (and How to Stop Them)," Fast Company, January 27, 2017, <https://www.fastcompany.com/3067587/work-smart/why-other-people-wreck-brainstorms-and-how-to-stop-them>.

¹⁴⁶ Johnson, "Improved Web 2.0 Strategy," i.

how much time and financial resources can be required to engage a wide array of partners.¹⁴⁷ This challenge, he asserts, could be improved by leveraging Web 2.0 technologies, another recurring theme found during the research for this thesis.

The shared situational awareness that current technology can facilitate also contributes to the achievement of a “common operating picture.” A shared understanding of the environment is crucial for parties with a common mission or purpose; it not only reduces duplication of efforts, it also provides critical “deconfliction” to avoid harm. As Johnson notes, “shared situational awareness involves stakeholders understanding a situation the same way.”¹⁴⁸ As innovative approaches and multi-perspective approaches to problem solving are contemplated in this thesis, shared understanding of a problem may be especially important for crises when misunderstandings can have damaging consequences.

One noteworthy approach enabled by the strengths of Web 2.0 is matching interests to opportunities. In a simple yet effective approach, community-level organizations often host webpages through which citizens explore causes or concerns such as animal rights, youth or elder care, homelessness, literacy, etc., to find volunteer opportunities in those areas.¹⁴⁹ This approach can facilitate the efforts of the citizen desiring to make a contribution. If crowdsourcing models were to proliferate in the public sector, a database or catalogue of ideas may be useful across disciplines. In genomic studies, cancer researchers have recognized the impact of multiple studies, sometimes years and continents apart, examining the same sets of specimens. This lack of shared information can result in unrecognized duplication, inadvertent inflation of prediction accuracies, and ultimately, impact on research results. Known as the “doppelgänger

¹⁴⁷ Johnson, “Improved Web 2.0 Strategy,” 3.

¹⁴⁸ Mica R. Endsley, “Toward a Theory of Situation Awareness in Dynamic Systems,” *Human Factors* 37, no. 1 (March 1995), as cited in Johnson, “Improved Web 2.0 Strategy”; Albert A. Nofi, *Defining and Measuring Shared Situational Awareness* (CRM D0002895.A1/Final) (Alexandria, VA: Center for Naval Analyses, 2000), as cited in Johnson, “Improved Web 2.0 Strategy.”

¹⁴⁹ “Ewing Township, NJ,” VolunteerMatch, accessed March 2, 2017, and <https://www.volunteermatch.org/search?l=Ewing%20Township%2C%20NJ>.

effect,” researchers identified duplicate genomic signatures in 50 percent of studies.¹⁵⁰ In the context of genomic analysis, unrecognized duplication is potentially negative; in the context of crowdsourcing and citizen engagement, duplication simply represents missed opportunities and unnecessarily expended effort. By recognizing the potential for this dynamic to occur, engaged agencies can develop the means to mine data for useful ideas generated by crowdsourcing.

D. SERVING THE CITIZEN CUSTOMER

Kelly Marie Smith and Lisa Gross, writing for *The Public Manager*, consider the role of design thinking in citizen service, and note that technological engagement is changing the way businesses serve their customers.¹⁵¹ Smith and Gross also cite a notable crossover of customer service technologies, methodologies, and platforms from the private to government application. They discuss several government agencies creating innovation platforms such as the U.S. Office of Personnel Management (OPM) Innovation Lab, U.S. Health and Human Services Idea Lab, and the U.S. General Services Administration (GSA) “18F” Division.¹⁵²

Smith and Gross note, “Design thinking enables public-sector leaders to generate new ideas by reframing assumptions and constraints.”¹⁵³ The synthesis of data, Smith and Gross contend, is enabled by design thinking and affords researchers the opportunity to “identify patterns, trends, and causation.”¹⁵⁴ Their concluding projection is that this trend will continue to proliferate, and governments will be influenced by citizens to

¹⁵⁰ Levi Waldron et al., “The Doppelgänger Effect: Hidden Duplicates in Databases of Transcriptome Profiles,” *Journal of the National Cancer Institute* 108, no. 11 (2016): djw146, doi: 10.1093/jnci/djw146.

¹⁵¹ Lisa Gross and Kelly Marie Smith, “Applying Design Thinking to Citizen Service,” *The Public Manager*, June 15, 2015, <https://www.td.org/Publications/Magazines/The-Public-Manager/Archives/2015/Summer/Applying-Design-Thinking-to-Citizen-Service>.

¹⁵² Katherine Archuleta, “OPM’s Lab Leading Government Innovation,” *Our Director*, May 21, 2015, <https://www.opm.gov/blogs/Director/2015/5/21/OPMs-Lab-Leading-Government-Innovation>; “HHS Idea Lab,” accessed February 11, 2017, <https://www.hhs.gov/idealab>; “18F,” accessed February 11, 2017, <https://18f.gsa.gov>.

¹⁵³ Gross and Smith, “Design Thinking.”

¹⁵⁴ *Ibid.*

become more adaptive to their needs. A citizen-driven model will surely “move the needle” closer to government as a platform rather than a vending machine.¹⁵⁵

E. MORE ON THE BUSINESS MODEL

Viewing HSE crowdsourcing through the prism of business models can be informative. It enables us to see problem solving from the perspective of the private sector, an intellectual talent pool from which the HSE might draw for its cognitive surplus.¹⁵⁶ Thomas Kohler, an associate professor of marketing at Hawaii Pacific University, contends that “technology has transformed individuals from mere consumers of products to empowered participants in value co-creation.”¹⁵⁷ If citizens are viewed as consumers of informational products from the HSE, then perhaps they can be engaged as co-creators as well.

Kohler takes an appreciative-inquiry approach to examining a number of successful models in an attempt to discern patterns of effectiveness. Among his findings, companies “are under pressure” to remake their business models “as company borders are dissolving and the value-creation process is changing from linear to networked, from top-down to bottom-up, from centralized to decentralized, and from closed to open.”¹⁵⁸ This assessment bears noteworthy similarities to contemporary trends in government, from task-force models to the whole-community approach.¹⁵⁹ “The goal for any crowdsourcing platform,” Kohler states, “is to engage a crowd that has both the willingness and capability to engage in value creation.”¹⁶⁰ In an era when finite resources

¹⁵⁵ Rodrigo Nieto-Gomez, “Visualizing Government as a Platform” (lecture, Naval Postgraduate School, Monterey, CA, January 2016).

¹⁵⁶ Shirky, *Cognitive Surplus*.

¹⁵⁷ Thomas Kohler, “Crowdsourcing-Based Business Models: How to Create and Capture Value,” *California Management Review* 57, no. 4 (Summer 2015): 63–94; Professor Kohler is also a visiting scholar at UC Berkeley and the University of Innsbruck.

¹⁵⁸ Kohler, “Crowdsourcing-Based Business Models,” 63–64; Henry Chesbrough, *Open Business Models* (Boston: Harvard Business Press, 2006).

¹⁵⁹ “Whole Community,” FEMA, last modified January 23, 2017, <https://www.fema.gov/whole-community>.

¹⁶⁰ Kohler, “Crowdsourcing-Based Business Models,” 64.

continue to drive the creation of partnerships and regional approaches, creating pathways to such engagement is as important as the engagement itself.

F. PATHWAYS AND PLATFORMS

Public–private partnerships are a critical part of the homeland security landscape.¹⁶¹ They underlie important efforts in the areas of critical infrastructure, technology, and resilience. Implicit in these alliances is the importance of understanding each other’s needs. The needs of private-sector owners and operators include a host of sector-specific physical security, operational resilience, and, importantly, proprietary and privacy concerns that must be understood by the government entities engaging with them. The needs of government include understanding the threats and vulnerabilities that concern owners and operators, and what potential consequences could result if those threats were realized. Furthermore, government entities must understand second- and third-order effects (and so on) of disruptions or compromises, and work with private-sector partners across a multitude of lifeline sectors to understand the interdependencies of these sectors and possible cascading consequences.¹⁶² These partnerships are, in fact, pathways to the exchange of information that is important to both parties. When formed, these partnerships represent the adoption of a new business model for both sides.

Kohler discusses public–private partnerships as well. He describes how “opening up certain processes and resources to external creators can transform a product into an interactive platform.”¹⁶³ Public–private partnerships also represent a kind of platform for the exchange of knowledge, and a crowdsourcing model, in that parties have engaged beyond their own realms to seek solutions to problems, or simply to seek answers to

¹⁶¹ “Office of Public–Private Partnerships,” DHS, accessed January 31, 2017, <https://www.dhs.gov/science-and-technology/office-public-private-partnerships>; “Critical Infrastructure Protection Partnerships and Information Sharing,” DHS, last modified December 30, 2016, <https://www.dhs.gov/critical-infrastructure-protection-partnerships-and-information-sharing>; “Critical Infrastructure Sector Partnerships,” DHS, last modified December 30, 2016, <https://www.dhs.gov/critical-infrastructure-sector-partnerships>.

¹⁶² “Critical Infrastructure Sectors,” DHS, last modified December 30, 2016, <https://www.dhs.gov/critical-infrastructure-sectors>.

¹⁶³ Kohler, “Crowdsourcing-Based Business Models,” 64.

questions beyond their own capacity to answer. These partnerships have an element of value co-creation inherent in their design.

The U.S. Department of Homeland Security’s Regional Resiliency Assessment Program (RRAP) is a perfect example of the public–private partnership for the exchange of knowledge.¹⁶⁴ DHS works with private-sector organizations, typically in concert with the National Laboratory System, to conduct comprehensive critical infrastructure sector assessments (RRAPs) with the goal of improving resiliency.¹⁶⁵ Government partners at every level are involved as they embark on what is typically a year-long examination of the subject sector and its interdependent sectors. These examinations are complex; the knowledge created is not always linear or predictable, and there are nearly innumerable variables in play in any given scenario that can affect outcomes. In Kohler’s work, he looks at the need to adopt an open business model, and how that “makes a significantly greater set of resources available to the company and allows it to share ideas and technologies with others.”¹⁶⁶

Through a multitude of lenses—from security, response, and utility concerns to planning, research, and academic interests—this collective works to create knowledge and value in a non-competitive, non-regulatory context. In this way, RRAPs behave like a crowdsourcing initiative, where the parties to the collective represent the crowd. Like the public–private partnerships described in this chapter, RRAPs are in many ways an open business model. However, RRAPs can also be viewed as a platform upon which collaboration can occur.

In a lecture at the Naval Postgraduate School’s Center for Homeland Defense and Security, Professor Rodrigo Nieto-Gomez spoke to students about visualizing government as a platform rather than a vending machine.¹⁶⁷ Platforms extend the reach

¹⁶⁴ “Regional Resiliency Assessment Program,” DHS, last modified August 24, 2016, <https://www.dhs.gov/regional-resiliency-assessment-program>.

¹⁶⁵ “About the National Labs,” Department of Energy, accessed February 2, 2017, <https://www.energy.gov/about-national-labs>.

¹⁶⁶ Kohler, “Crowdsourcing-Based Business Models,” 64.

¹⁶⁷ “Center for Homeland Defense and Security,” accessed February 1, 2017, <https://www.chds.us/c/>; Nieto-Gomez, “Visualizing Government as a Platform.”

of collaborators and increase their capacity for value creation. In the HSE, that value may manifest in a number of ways: savings by way of combined resources; greater mission efficacy by way of partnerships and reduction in duplication; and the exponential expansion of knowledge that occurs in a task force or collaborative environment.

Extending reach and capacity for value creation are two benefits of the collaborative constructs described in this chapter, but building platforms and developing pathways holds additional potential for the HSE: both can create the conditions for enhanced civic engagement. If viewed through the lens of Professor Nieto-Gomez's ideas, a government that serves as a platform for value creation (rather than merely a vending machine for services) may engender participation by its citizens more readily. One of the challenges in this scenario, then, is creating a value proposition for their participation, for their contributions. While monetary incentives may generally be a first thought, it may well be that the opportunity to participate and be recognized for their contribution is adequate for the citizens motivated by the idea of civic engagement, rather than some tangible benefit for themselves.

Peter Diamandis is an engineer, physician, and entrepreneur prolific on subjects of technology and innovation.¹⁶⁸ He advances several observations that have direct bearing on the topic of crowdsourcing and engagement. In two particular blog posts, he considers the risk-averse nature of government and the possible impact of this posture on American technological superiority—some would even say primacy.¹⁶⁹ He contrasts the reduction in research and development dollars in the United States to the ascendance of other countries in some areas of research. While this issue may lie beyond the scope of this thesis, another facet of the story does not: the concomitant of expansion of entrepreneurial innovation in the United States. With what he terms “the democratization of entrepreneurship,” there has been a notable increase in the creation of innovative

¹⁶⁸ “Peter H. Diamandis,” accessed February 2, 2017, <http://diamandis.com/>.

¹⁶⁹ Peter Diamandis, “Entrepreneurs Not Government Drive Innovation: Here’s Why,” Peter H. Diamandis, accessed February 2, 2017, <http://www.diamandis.com/blog/entrepreneurs-not-government-drive-innovation-heres-why>; Peter Diamandis, “Experimenting with Government,” *Tech Blog*, accessed February 7, 2017, <http://www.diamandis.com/index.php/blog/experimenting-with-government>.

solutions for longstanding problems.¹⁷⁰ He expresses that “if we can continue to incentivize and support entrepreneurs to devote their time to solving the world’s biggest problems, we will see enormous economic upside in the long run.”¹⁷¹ Herein lies the essence: opening up the business model, creating a platform, and creating the pathway to it.

G. ANALYSIS

Where previous chapters studied several models of engagement and crowdsourcing, Chapter IV considered implementation. What this thesis discovered in the process was connective tissue—ideas for connecting the concepts found across the models examined to endeavors in the HSE. If the models probed in Chapters II and III represent bricks, the ideas in Chapter IV are the mortar. The cornerstone of this analysis lies in Professor Kohler’s assessment, studied in Section E of this chapter: “The goal for any crowdsourcing platform,” Kohler states, “is to engage a crowd that has both the willingness and capability to engage in value creation.”¹⁷² In an era when finite resources continue to drive the creation of partnerships and regional approaches, creating pathways to such engagement is as important as the engagement itself.¹⁷³

Principal factors this thesis assesses as pertinent to the HSE include viewing government in general as a platform for innovation as opposed to a vending machine for the provision of services.¹⁷⁴ By understanding the psychology involved—citizens’ motivations to engage—government enterprises can begin to design optimal engagement opportunities. By considering the lessons being learned in business and customer service sectors, government can potentially design more optimal conditions for knowledge and value creation.

¹⁷⁰ Diamandis, “Entrepreneurs.”

¹⁷¹ Ibid.

¹⁷² Kohler, “Crowdsourcing-Based Business Models,” 64.

¹⁷³ Ibid.

¹⁷⁴ Noted in the “Serving the Citizen Customer section of this chapter”; Nieto-Gomez, “Visualizing Government as a Platform.”

H. CONCLUSION

The cases studied in this chapter afforded a view of a crowdsourcing and engagement through the prism of psychology, technology, and customer service. What materialized in this inquiry were themes and concepts that may prove useful if crowdsourcing and engagement practices were to be adopted in the HSE. This usefulness would come in the form of approaches and methodologies government agencies in the HSE might utilize if they were to pursue such initiatives. These include filtering and validation and understanding motivations and different approaches (divergent versus convergent thinking), as well as the role that social media and the Web can play not only in matching interests to opportunities, but as a means of engaging a wide array of partners. Using Shirky's concept of tapping into the intellectual reservoir of citizens, this chapter's examination also demonstrated that private-sector business can be a valuable resource for innovative ideas. Kohler's notion that opening up processes to external creators leads to value co-creation can have direct application to any crowdsourcing and engagement efforts eventually undertaken in the HSE.

The analyses and conclusions of this and the preceding chapters represent a collective of ideas, considerations, and frameworks with which to initiate dialogue in the HSE about crowdsourcing and engagement. Chapter V builds on the knowledge assembled in the preceding chapters—and the interrelatedness of the cases studied—in the context of this thesis's central question: How can crowdsourcing models help the HSE solve problems and create the conditions for enhanced civic engagement? Chapter V provides discussion beginning with this focal point and advances several recommendations for instituting crowdsourcing and engagement initiatives in the HSE.

V. DISCUSSION, RECOMMENDATIONS, AND CONCLUSION

This thesis began with the premise that the world has become a more dangerous and complicated place due to the spread of terrorism, damaging weather events, and other threats to national and economic security. That premise led to the examination of how crowdsourcing models can help the government's homeland security enterprise solve problems and create the conditions for enhanced civic engagement, and the hypothesis that, within the body of crowdsourcing and engagement models, a combination of ideas, examples, approaches and successes exists that demonstrates potential utility for the homeland security field. This study also took the position, however, that the conditions for tapping into citizens' intellectual capacity to help confront challenges that require problem solving may not be present.

Chapters II through IV moved through an examination of crowdsourcing in practice and a number of issues underlying engagement and implementation. This chapter synthesizes these findings, beginning with an example from the business world.

A. PATHWAYS AND PLATFORMS RESTATED

Mark Thompson, a senior lecturer in information systems, addresses how government may consider meeting the needs of its public in the provision of services.¹⁷⁵ Using an example from the business world to illustrate the point, he describes the demise of a familiar brick-and-mortar video-rental store and the precipitous rise of online content providers. He writes, "No amount of shiny new tech—blockchain, big data, internet of things, or the other memes—nor any amount of traditional accessibility measures—website refreshes, social media, mobile apps, or other redesign of the storefront—will entice us into a store that citizens don't want any more."¹⁷⁶ The traditional provision of services from the government can be viewed in this light. To remain relevant to younger and future generations and to best serve all citizens, the changing world around us

¹⁷⁵ Mark Thompson, "It's the Business Model, Stupid—Three Steps to Transform UK Public Services," *Computer Weekly*, accessed February 12, 2017, <http://www.computerweekly.com/opinion/Its-the-business-model-stupid-three-steps-to-transform-UK-public-services>.

¹⁷⁶ *Ibid.*

demands our attention and demands adaptation. It demands we strive to create pathways, platforms, and the conditions for change.

B. FROM RECOGNITION TO HARNESSING

The premise that government could benefit from the wisdom of the crowds, from the democratization of intellect, demands that one of the first questions be, “What would that look like?” At present, it looks like broad and valuable contributions to the public good, to borrow a phrase from Nancy Proctor’s *Museum Journal* article referenced in Chapter II.¹⁷⁷ The preceding chapters considered informed discussion about crowdsourced contributions across a broad spectrum of disciplines, including the natural sciences, social sciences, technology, public health, astronomy, business, and government. Notable successes and failures were present, the former greatly outnumbering the latter.

Using appreciative inquiry, this thesis discovered that contributions by non-professionals was a consistent theme, as was a need for a balanced approach that provides a safe framework within which to operate. There were examples of successful initiatives that were self-organized and aided by personal technology and some that needed only a platform to enable their motivation to contribute. In every instance, new partnerships formed and new knowledge was created. In every instance, pathways and platforms were part of the equation. And across the spectrum of cases reviewed one constant remained: the people who the HSE endeavors to protect. The hypothesis would appear to be validated in the course of this thesis’s examination. The cases examined for this thesis also address how crowdsourcing models can help the government’s HSE solve problems and create the conditions for enhanced civic engagement.

¹⁷⁷ Proctor, “Crowdsourcing,” 105–106.

C. RECOMMENDATIONS

This thesis advances several recommendations intended to amplify the role of participatory crowdsourcing models for problem solving across the homeland security enterprise and to foster conditions for increased civic engagement. Specifically, this thesis proposes that the exploration of these efforts be nested within the Naval Postgraduate School's University and Agency Partnership Initiative to optimize discussion among partners from multiple academic and professional disciplines within the HSE.¹⁷⁸ In more general terms, this thesis encourages the HSE to strive to create the conditions for knowledge co-creation. This can be accomplished by: Embracing and replicating successful models from a variety of sectors; creating pathways for citizens to make meaningful contributions of intellect and creativity to help develop the problem-solving capacity of the HSE as it moves into the future and encounters new challenges and opportunities; reconsidering traditional business models in government to assess if they best position the nation for the next generation of citizen-contributors and civic engagement; and cultivating the ethos of government as a platform for innovation. The following specific recommendations offer a starting point:

1. Convene a multidisciplinary commission under the auspices of FEMA and DHS to further explore and advance the issue.
 - (a) Committee membership should represent the security, academic, and scientific communities and the private sector, and create special opportunities for high school students to participate.
 - (b) Sub-committees could include technology, public safety, education, and science.
 - (c) The commission would develop goals and an agenda that progress toward an annual White House roundtable. A potential model is the September 2016 White House Preparedness Roundtable organized by the White House National Security Council staff.
 - (d) Commission work would include the development of best practices and a universally accepted code of ethics for crowdsourcing models. This would contribute to a safe framework without unduly constraining innovation.

¹⁷⁸ "University and Agency Partnership Initiative (UAPI)," Center for Homeland Defense and Security, accessed April 17, 2017, <https://www.chds.us/c/academic-programs/uapi>.

- (e) One of the primary goals of the commission would be to help communities, e.g., academic, scientific, technological, business, etc., interested in applying participatory crowdsourcing models, to “get-to-yes” rather than become mired in obstacles, concerns, and potential liability issues.¹⁷⁹
2. Have FEMA and/or DHS select several agencies to host pilot programs for crowdsourcing projects.
 - (a) Designate project leads and adequately resource them to develop the initiative and establish a proof-of-concept that could be field tested with real-world data.
 - (b) Charge these project leads with developing recommendations for additional agency sites for development.
 - (c) Develop public-facing portals on host-agency websites that list a selection of the major initiatives, challenges, or problems that agency is working on to solicit ideas for resolving them. Specify a period of time available for contribution of ideas.
 - (d) Citizen contributors could elect to be contacted for further engagement or leave their ideas anonymously.
 3. Dedicate further inquiry and research to incorporating social science curriculum into homeland security education (or viewing homeland security as a social science) to better understand the human aspects of homeland security endeavors. For further, see:
 - (a) Rockhurst University Professor Jeffrey R. Breese’s, School of Graduate & Professional Studies, work on this issue.¹⁸⁰
 - (b) Work on creative and deliberate problem-solving styles by researchers at Maastricht University, the University of Illinois, and Indiana University.¹⁸¹

¹⁷⁹ A reference to the book by the same name; William R. Ury, Roger Fisher, and Bruce Patton, *Getting to Yes* (Boston: Houghton Mifflin, 1981).

¹⁸⁰ Jeffrey R. Breese, “Reflections on the Practice of Sociology: Sociology, a Community Engagement Discipline,” *Journal of Applied Social Science*, 5, no. 1 (March 2011): 77–86.

¹⁸¹ Dominik Mahr, Aric Rindfleisch, and Rebecca J. Slotgraaf, “Enhancing Crowdsourcing Success: The Role of Creative and Deliberate Problem-Solving Styles,” *Customer Needs and Solutions* 2, no. 3 (September 2015): 209–221.

D. CONCLUSION

The examination of engagement and crowdsourcing models provided a number of ideas for the generation of knowledge, exchange of information, and innovation in approaches to problem solving in the HSE. This thesis began with the idea that, to create change, the conditions for change must first be present. That idea remains the essence of this thesis: that to generate new ideas, information, and innovation in the homeland security enterprise, we must first create the policy space for it. We have to till the soil.

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

- Adamski, Shayne. "Crowdsourcing Disasters and Social Engagement Multiplied." FEMA, August 2, 2013. <https://www.fema.gov/blog/2013-08-02/crowdsourcing-disasters-and-social-engagement-multiplied>, accessed 1/18/17.
- Archuleta, Katherine. "OPM's Lab Leading Government Innovation." *Our Director*, May 21, 2015. <https://www.opm.gov/blogs/Director/2015/5/21/OPMs-Lab-Leading-Government-Innovation>
- Audubon. "History of the Christmas Bird Count." Accessed February 10, 2017. <http://www.audubon.org/history-christmas-bird-count>.
- Barrett, Frank J., and Ronald E. Fry. *Appreciative Inquiry: A Positive Approach to Building Cooperative Capacity* (second printing). Chagrin Falls, OH: Taos Institute, 2008.
- Bingham, Lisa Blomgren, Tina Nabatchi, and Rosemary O'Leary. "The New Governance: Practices and Processes for Stakeholder and Citizen Participation in the Work of Government." *Public Administration Review* 65, no. 5 (September 2005): 547–558.
- Box, Richard C. "Private Lives and Anti-Administration." *Administrative Theory and Praxis* 23, no. 4 (2001): 541–558.
- Breese, Jeffrey R. "Reflections on the Practice of Sociology: Sociology, a Community Engagement Discipline." *Journal of Applied Social Science*, 5, no. 1 (March 2011): 77–86.
- Briscoe, Gerard, and Catherine Mulligan. "Digital Innovation: The Hackathon Phenomenon" (Working Paper No. 6). Creativeworks London, May 2014. <http://www.creativeworkslondon.org.uk/wp-content/uploads/2013/11/Digital-Innovation-The-Hackathon-Phenomenon1.pdf>.
- Bull, Glen, Ann Thompson, Mike Searson, Joe Garofalo, John Park, Carl Young, and John Lee. "Connecting Informal and Formal Learning: Experiences in the Age of Participatory Media." *Contemporary Issues in Technology and Teacher Education* 8, no. 2(2008): 100–107. <http://www.citejournal.org/volume-8/issue-2-08/editorial/connecting-informal-and-formal-learning-experiences-in-the-age-of-participatory-media>
- Büscher, Monika, and Michael Liegl. "Connected Communities in Crisis." ResearchGate pre-print, 2015. https://www.researchgate.net/publication/261708601_Connected_Communities_in_Crises.

- Campbell, Mary Pat. "What I've Learned from the Good Judgement Project." *Forecasting & Futurism Newsletter* 11 (July 2015): 17–22.
- Center for Homeland Defense and Security. "University and Agency Partnership Initiative (UAPI)." Accessed April 17, 2017. <https://www.chds.us/c/academic-programs/uapi>.
- Chesbrough, Henry. *Open Business Models*. Boston: Harvard Business Press, 2006.
- Chung, Archon. "Varieties of Participation in Complex Governance." *Public Administration Review* 66, no. s1 (December 2006): 66–75.
- DARPA. "About DARPA." Accessed February 3, 2017. <http://www.darpa.mil/about-us/about-darpa>
- . "DARPA Network Challenge: We Have a Winner!" Accessed February 4, 2017. <http://archive.darpa.mil/networkchallenge/index.html>.
- Demediuk, Peter. "Innovative Community Engagement by Local Government: Harnessing Diversity for Voice, Compromise, and Shared Responsibility." *International Journal of Diversity in Organisations, Communities & Nations* 9, no. 3 (July 2009): 51–65.
- Department of Energy. "About the National Labs." Accessed February 2, 2017. <https://www.energy.gov/about-national-labs>.
- Department of Homeland Security (DHS). "Critical Infrastructure Protection Partnerships and Information Sharing." Last modified December 30, 2016. <https://www.dhs.gov/critical-infrastructure-protection-partnerships-and-information-sharing>
- . "Critical Infrastructure Sector Partnerships." Last modified December 30, 2016. <https://www.dhs.gov/critical-infrastructure-sector-partnerships>.
- . "Critical Infrastructure Sectors." Last modified December 30, 2016. <https://www.dhs.gov/critical-infrastructure-sectors>.
- . "Office of Public–Private Partnerships." Accessed January 31, 2017. <https://www.dhs.gov/science-and-technology/office-public-private-partnerships>
- . *Quadrennial Homeland Security Review*. Washington, DC: DHS, June 2014. <https://www.dhs.gov/sites/default/files/publications/2014-qhsr-final-508.pdf>.
- . "Regional Resiliency Assessment Program." Last modified August 24, 2016. <https://www.dhs.gov/regional-resiliency-assessment-program>.

- Diamandis, Peter. “Entrepreneurs Not Government Drive Innovation: Here’s Why.” Peter H. Diamandis, accessed February 2, 2017. <http://www.diamandis.com/blog/entrepreneurs-not-government-drive-innovation-heres-why>.
- . “Experimenting with Government.” *Tech Blog*. Accessed February 7, 2017. <http://www.diamandis.com/index.php/blog/experimenting-with-government>.
- Dodds, Peter S., Roby Muhamad, and Duncan J. Watts. “An Experimental Study of Search in Global Social Networks.” *Science* 301 (August, 2003): 827–829.
- Dunn, William N. “Methods of the Second Type: Coping with the Wilderness of Conventional Policy Analysis.” *Review of Policy Research* 4, no. 7 (1988): 720–737.
- . “Pragmatic Eliminative Induction: Proximal Range and Context Validation in Applied Social Experimentation.” *Philosophica* 2, no. 60 (1997): 75–112.
- . “Using the Method of Context Validation to Mitigate Type III Errors in Environmental Policy Analysis.” In *Knowledge, Power and Participation in Environmental Policy Analysis*, edited by Matthijs Hisschemoller, Rob Hoppe, Williams N. Dunn, and Jerry R. Ravetz, 417–436. Piscataway, NJ: Transaction Publishers, 2001.
- EdVenture Partners. “Peer to Peer.” Accessed February 21, 2017. <https://edventurepartners.com/peer2peer/>.
- Farrell, John L. “Community Engagement for Collective Resilience: The Rising System.” Master’s thesis, Naval Postgraduate School, 2012.
- FEMA. “Whole Community.” Last modified January 23, 2017. <https://www.fema.gov/whole-community>.
- Fienen, Michael N., and Christopher S. Lowry. “Social.Water—A Crowdsourcing Tool for Environmental Data Acquisition.” *Computers and Geosciences* 49 (December 2012):164–169. doi: 10.1016/j.cageo.2012.06.015.
- Griffin, Amanda. “Crowdsourcing Robots: College Students Help NASA on its Journey to Mars.” NASA, May 13, 2016. <https://www.nasa.gov/feature/crowdsourcing-robots-college-students-help-nasa-on-its-journey-to-mars>, accessed 2/11/17, last updated 5/16/16.
- Gross, Lisa, and Kelly Marie Smith. “Applying Design Thinking to Citizen Service.” *The Public Manager*, June 15, 2015. <https://www.td.org/Publications/Magazines/The-Public-Manager/Archives/2015/Summer/Applying-Design-Thinking-to-Citizen-Service>.

- Halman, Alexander. "Before and Beyond Anticipatory Intelligence: Assessing the Potential for Crowdsourcing and Intelligence Studies." *Journal of Strategic Studies* 8, no. 3 (Fall 2015): 15–24. doi: 10.5038/1944-0472.83S.1468.
- Hoffman, John, Julie Wallach, and Eduardo Sanchez. "Community Service Work, Civic Engagement, and Giving Back to Society: Key Factors in Improving Interethnic Relationships and Achieving Connectedness in Ethnically Diverse Communities." *Australian Social Work* 63, no. 4 (December 2010): 418–430.
- Hoffman, Sydney S. "Enhanced Resilience through Expanded Community Preparedness in the United States: Application of Israeli Models." Master's thesis, Naval Postgraduate School, 2014.
- Howe, Jeff. *Crowdsourcing: Why the Power of the Crowd Is Driving the Future of Business* (1st ed.). New York: Crown, 2008.
- . "Crowdsourcing: Why the Power of the Crows Is Driving the Future of Business." The International Achievement Institute. Accessed March 25, 2017. <http://www.bizbriefings.com/Samples/IntInst%20---%20Crowdsourcing.PDF>.
- IARPA. "About IARPA." Accessed February 3, 2017. <https://www.iarpa.gov/index.php/about-iarpa>.
- Johnson, Peter, and Pamela Robinson. "Civic Hackathons: Innovation, Procurement, or Civic Engagement?" *Review of Policy Research* 31, no. 4 (July 2014): 349–357. doi: 10.1111/ropr.12074.
- Johnson, Samuel Rhodes II. "Improved Web 2.0 Strategy for FEMA to Enable Collaboration and a Shared Situational Awareness across the Whole of Community." (Master's thesis, Naval Postgraduate School, 2012).
- Kar, Bandana, Renee Sieber, Muki Haklay, and Rina Ghose. "Public Participation GIS and Participatory GIS in the Era of GeoWeb." *The Cartographic Journal* 53, no. 4 (December 2016): 296–299. doi: 10.1080/00087041.2016.1256963.
- Kohler, Thomas. "Crowdsourcing-Based Business Models: How to Create and Capture Value." *California Management Review* 57, no. 4 (Summer 2015): 63–94.
- Korpela, Eric, Dan Werthimer, David Anderson, Jeff Cobb, and Matt Lebofsky. "SETI@Home—Massively Distributed Computing For SETI." *Computing in Science and Engineering* (January/February 2001): 78–83.
- Law, Edith, Krzysztof Z. Gajos, Andrea Wiggins, Mary L. Gray, and Alex Williams. "Crowdsourcing as a Tool for Research: Implications of Uncertainty." *CSCW 2017*: 1544–15561. doi: <http://dx.doi.org/10.1145/2998181.2998197>.

- Mahr, Dominik, Aric Rindfleisch, and Rebecca J. Slotgraaf. "Enhancing Crowdsourcing Success: The Role of Creative and Deliberate Problem-Solving Styles." *Customer Needs and Solutions* 2, no. 3 (September 2015): 209–221.
- Markman, Art. "Why Other People Wreck Brainstorms (and How to Stop Them)." Fast Company, January 27, 2017. <https://www.fastcompany.com/3067587/work-smart/why-other-people-wreck-brainstorms-and-how-to-stop-them>.
- Mason, Winter, and Duncan J. Watts. "Financial incentives and the Performance of Crowds." *Proceedings of the KDD Workshop on Human Computation* (2009): 77–85.
- Millikan, Frank Rives. "Joseph Henry: Father of Weather Service." Smithsonian Institution. Accessed October 21, 2012. <http://siarchives.si.edu/history/jhp/joseph03.htm>.
- NASA. "NASA Engages the Public to Discover New Uses for Out-of-this-World Technologies." October 23, 2013. <https://www.nasa.gov/content/nasa-engages-the-public-to-discover-new-uses-for-out-of-this-world-technologies>.
- Obermeyer, Nancy J. "The Evolution of Public Participation GIS." *Cartography and Geographic Information Systems* 25, no. 2(1998): 65–66.
- Porter, Jason B. "Energizing the Enterprise: An Incentive-Based Approach to Homeland Security." Master's thesis, Naval Postgraduate School, 2010.
- Proctor, Nancy. "Crowdsourcing—An Introduction: From Public Goods to Public Good." *Curator: The Museum Journal* 56, no. 1 (January 2013): 105–106. doi: 10.1111/cura.12010.
- Ravert, Brian P. "Protecting America through Better Civic Education." Master's thesis, Naval Postgraduate School, 2013.
- Rhodes, R. A. W. "The New Governance: Governing without Government." *Political Studies* 44, no. 4 (September 1996): 652–667. doi: 10.1111/j.1467-9248.1996.tb01747.x.
- Sethi, Rajiv. "Nash Equilibrium." In *International Encyclopedia of the Social & Behavioral Sciences*, 2nd edition, edited by James D. Wright, 540–542. Amsterdam: Elsevier, 2015.
- Shirky, Clay. *Cognitive Surplus: Creativity and Generosity in a Connected Age*. New York: Penguin, 2010.
- . "Tapping the Cognitive Surplus." *The Futurist* 44, no 6 (November-December 2010): 21.

- Sieber, Renee. "Public Participation Geographic Information Systems: A Literature Review and Framework." *Annals of the Association of American Geographers* 96, no. 3(2006): 491–507.
- Soden, Robert, and Leysia Palen. "From Crowdsourced Mapping to Community Mapping: The Post-earthquake Work of OpenStreetMap Haiti." *Proceedings of the 11th International Conference on the Design of Cooperative Systems* (May 2014). doi: 10.1007/978-3319-06498-7_19.
- Solomon, Jason M. "New Governance, Preemptive Self-regulation, and the Blurring of Boundaries in Regulatory Theory and Practice." *Wisconsin Law Review* (2010): 591–625. <http://scholarship.law.wm.edu/facpubs/680>.
- Spiegel, Alix. "So You Think You're Smarter than a CIA Agent." NPR, April 2, 2014, <http://www.npr.org/sections/parallels/2014/04/02/297839429/-so-you-think-youre-smarter-than-a-cia-agent>, accessed 2/4/17.
- Tang, John C., Manuel Cebrian, Nicklaus A. Giacobe, Hyun-Woo Kim, Taemie Kim, and Douglas "Beaker" Wickert. "Reflecting on the DARPA Red Balloon Challenge." *Communications of the ACM* 54, no. 4 (April 2011): 78–85. doi: 10.1145/1924421.1924441.
- Tapia, Andrea H., Nicolas LaLone, and Hyun-Woo Kim. "Run Amok: Group Crowd Participation in Identifying the Bomb and Bomber from the Boston Marathon Bombing." *Proceedings of the 11th International ISCRAM Conference* (May 2014): 265–274.
- Tetlock, Philip, Barbara Mellers, Eric Stone, Pavel Atanasov, Nick Rohrbaugh, S. Emlen Metz, Lyle Ungar, Michael M. Bishop, Michael Horowitz, and Ed Merkle. "The Psychology of Intelligence Analysis: Drivers of Prediction Accuracy in World Politics." *Journal of Experimental Psychology: Applied* 21, no. 1 (2015): 1–14. doi: 10.1037/xap0000040.
- Thompson, Mark. "It's the Business Model, Stupid—Three Steps to Transform UK Public Services." *Computer Weekly*. Accessed February 12, 2017, <http://www.computerweekly.com/opinion/Its-the-business-model-stupid-three-steps-to-transform-UK-public-services>.
- Ungar, Lyle, Barb Mellors, Ville Satopää, Jon Baron, Phil Tetlock, Jaime Ramos, and Sam Swift. *The Good Judgement Project: A Large Scale Test of Different Methods of Combining Expert Predictions* (AAAI Technical Report FS-12-06). Palo Alto, CA: Association for the Advancement of Artificial Intelligence, 2012.
- Ushahidi. "About Ushahidi." Accessed February 11, 2017. <https://www.ushahidi.com/about>.

- VolunteerMatch. "Ewing Township, NJ." Accessed March 2, 2017.
<https://www.volunteermatch.org/search?l=Ewing%20Township%2C%20NJ>.
- Waldron, Levi, Markus Riestler, Marcel Ramos, Giovanni Parmigiani, and Michael Birrer. "The Doppelgänger Effect: Hidden Duplicates in Databases of Transcriptome Profiles." *Journal of the National Cancer Institute* 108, no. 11 (2016): djw146. doi: 10.1093/jnci/djw146.
- Wiersma, Yolanda F. "Birding 2.0: Citizen Science and Effective Monitoring in the Web 2.0 World." *Avian Conservation and Ecology* 5, no. 2 (2010). <http://www.ace-eco.org/vol5/iss2/art13/>.
- Williams, David R. "The Apollo 13 Accident." NASA, accessed February 11, 2017.
<http://nssdc.gsfc.nasa.gov/planetary/lunar/ap13acc.html>.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Ft. Belvoir, Virginia
2. Dudley Knox Library
Naval Postgraduate School
Monterey, California