

Special Issue Editorial

Digital government and wicked problems: Solution or problem?

Jing Zhang^{a,*} and Yushim Kim^b

^a*Graduate School of Management, Clark University, Worcester, MA, USA*

^b*School of Public Affairs, Arizona State University, Phoenix, AZ, USA*

Abstract. The theme of the 16th International Conference on Digital Government Research (dg.o 2015) – “Digital Government and Wicked Problems” – drew attention to the increasingly complex global problems we are facing today. In the late 1960s, the term “wicked problems” was coined to refer to societal and public planning problems that had no definitive solutions [1,2]. Many problems, such as those identified in the theme of the conference – climate change, urbanization, and inequality – often exhibit the characteristics of “wickedness” in the sense that they are both difficult to define and solve. The selection of this theme for dg.o 2015 reflects the digital government research community’s ambition and dedication to achieve a degree of understanding necessary to address some of the most intractable of these problems with the aid of emerging technologies. This special issue includes seven of the best papers from the dg.o 2015 conference.

In this editorial, we highlight the characteristics of “wicked problems” briefly, and the way in which the term is relevant in digital government research. We then introduce the articles selected for this special issue. Lastly, we provide suggestions to foster future research that addresses the nature of “wickedness” in digital government initiatives.

Keywords: Wicked problems, digital government, open data, smart grid, public health, crisis management, digital divide, and social media

1. Digital government: Solution or problem?

Rittel and Webber [2] identified ten distinctive properties of wicked problems (see Table 1). There is no possibility for an exhaustive formulation of the problem; no final rule for an open interacting system; solutions can only be judged as good-or-bad, not true-or-false, and every solution has consequences that leave no opportunities to learn by trial-and-error. For example, climate change has been characterized as a “super wicked problem” [3,4]. The nature of climate change is complex and rooted deeply in the interactions among social, political, and natural systems; causal relationships are troubled by uncertainty, and policy responses or solutions, especially those oriented towards short-term efficiency and economic gains, often produce adverse and irreversible consequences, and are thereby transformed into another set of wicked problems [3]. Similar challenges plague problems like urbanization and inequality. Worse, there is no definitive way to describe these problems – their public good is disputable, and the definition of equality is subjective. Incomplete, conflicting, and changing requirements and the intricate connections and complex interdependencies of these problems also contribute to their definition as wicked.

*Corresponding author: Jing Zhang, Graduate School of Management Clark University Worcester, MA 01610-1477, USA. Tel.: +1 508 793 7102; Email: jizhang@clarku.edu.

Table 1
Distinctive properties of wicked problems

Distinguishing properties
1. No exhaustive formulation of a problem
2. No final rule
3. No true-or-false solutions, only good-or-bad
4. No immediate or ultimate test of a solution
5. Every solution a “one shot operation”
6. No exhaustive set of well-described potential solutions
7. Every problem essentially unique
8. Every problem a symptom of another problem
9. Representations of a problem numerous, and choice of representation determines the solution
10. The planner has no right to be wrong

Adapted from [2].

Some of these characteristics have manifested in digital government research as well, which has experienced steady growth in the past two decades [5,6]. From the outset, it was anticipated that information technologies would offer many benefits to government and society by reducing costs and improving the efficiency of government operations, for example, or even as a driving force in global administrative reforms [7]. Therefore, it is not surprising that there has been great hope for digital government’s potential to change fundamentally the ways in which public organizations are structured and operated, public services are delivered, policies are developed, implemented, and evaluated, and citizens engage in democratic processes.

However, the rapid adoption of information technologies by governments and society has also created a host of interrelated organizational, social, and political problems. Questions have arisen whether new media and ICTs empower or disenfranchise, unify or divide, and bridge the gap in social and economic inequality or widen it. These questions persist and defy premature and simple answers. For example, social media have been seen as exciting tools to foster transparency and citizen engagement in democratic societies [8]. Nevertheless, there is no guarantee that these tools are used exclusively for benevolent purposes. It is equally likely that Islamic State (IS) terrorist networks in Syria and Iraq exploit social media for global propaganda, radicalization, and recruitment [9]. Similarly, Hong and Kim showed that public opinions provided through online platforms such as Twitter are politically polarized [10]. Thus, the empirical evidence accumulated to date is equivocal. Articles in this special issue provide further and recent evidence of the role of ICTs in government and wicked problems.

Prior to our two tandem special issues in *Information Polity* and *Government Information Quarterly* based on the dg.o 2015 conference, the wicked nature of digital government initiatives had received no explicit recognition or dedicated attention [11]. Thus, in this special issue, we have highlighted the importance of viewing issues in digital government research through a subtle and complex lens. In our introduction to each paper in this selection, we identify areas that might exhibit the distinctive characteristics of “wickedness,” and at the same time, discuss unique advantages and opportunities that digital government research can offer in the management of wicked problems (see Table 2).

2. The special issue

The first paper in this special issue, *The Wicked Problem of Commercial Value Creation in Open Data Ecosystems – Policy Guidelines for Governments*, begins with the observation that previous studies on open data have assumed that open data initiatives will exert a positive influence on social, environmen

Table 2
Understanding wicked problems in digital government research

Article in the special issue	Areas and themes	Dominant characteristics exhibited	Lessons for managing wicked problems
<i>The Wicked Problem of Value Creation in Open Data Ecosystems – Policy Guidelines from an Open Data Innovation Case</i>	Open data; Value creation	<ul style="list-style-type: none"> – How value can be created from an open data initiative is ill-formulated, complex, and ill-structured; – Interdependency of external actors, and risk avoidance; – No criteria for, and no exhaustive set of solutions 	Open data policies focus on context-specific factors; ensuring the availability and quality of data, internal IT, open IT, knowledge, and governance resources; fostering business and citizens' collaboration; reducing negative effects.
<i>Real Options Analysis for Smart Grid: The Role of Information Technology and Public Policy</i>	Smart Grid; Investment under Uncertainty; Public Policy	<ul style="list-style-type: none"> – Large scale infrastructure change costly to implement; – Uncertainties about how and when these costs will be recovered; – Interdependency of public policy and private investment; interaction of technological, social, economic, and political changes in infrastructure changes 	Simulation that can incorporate uncertainty can help understand the nature of the problem, simulate complexed decision-making processes, and develop policy recommendations.
<i>Open Government Process and Government Transparency in Crisis Communication under Hyper-Uncertainty: The Case of AirAsia QZ8501 Crash</i>	Crisis management; Government transparency; Open process	<ul style="list-style-type: none"> – Hyper-unknown; – Hyper-uncertainty; need for expedient and decisive responses 	Openness of search and rescue process is the most salient antecedent to perception of government transparency
<i>Technology, Governance, and the Escalation of Ebola: Wicked Problems in Real Time</i>	Public health; Crisis management;	<ul style="list-style-type: none"> – Perfectly logical steps result in unexpected consequences; – Cross-border, cross-jurisdiction, and inter-organizational collaboration needs; – Limited communication and public health infrastructure; vicious cycle created by interaction of deadly disease, weak governance capability, limited communication, and health infrastructure 	Development of information and communication technologies (ICTs) and community actors who can understand the social networks and use ICTs effectively
<i>A Study on the Digital Divide in the Smart Era: The Moderating Effect of Smartphones</i>	Digital Divide; Smartphone; Information gap	<ul style="list-style-type: none"> – Unintended consequence of proliferation of ICTs in social, economic, political, and cultural realms; – Access is a multi-dimensional concept, including motivation, physical access, skill access, and use access; technology changes rapidly, creating new divides as old divide narrows 	Relative low price, ease of use, and multi-functionality of smartphones have served to narrow the divide. Policies targeting digital divide should seek to provide access to smart device and use.
<i>The Client-consultant Relationship in ERP Implementation in Government: Exploring the Dynamic between Power and Knowledge</i>	Organizational factors; ERP implementation; Power/knowledge	<ul style="list-style-type: none"> – ERP implementation is complex, costly, and failure-prone. Commonly accepted mode of project leadership and management, resource allocation, and risk management may not be sufficient in public sector 	Context factors, such as power relationships and knowledge transfer, need to be considered in ERP implementation
<i>Citizens' Perceptions of the Impact of Information Technology Use on Transparency, Efficiency and Corruption in Local Governments</i>	Social media; Transparency; Organizational effects	<ul style="list-style-type: none"> – Implementation of ICTs may not have a significant effect on citizens' perceptions of transparency, efficiency, and corruption. 	Different media may have different effects on citizens' perceptions of government transparency, efficiency, and corruption.

-tal, and economic values, particularly the commercial value of businesses. Instead, Zuiderwijk and her colleagues attempted to understand the dark side – the wicked aspects of commercial open data value creation – and to provide guidelines for establishing an ecosystem that has the potential to manage these adverse aspects. Based on expert consultation, the authors argue that, in order to mitigate the wickedness of open data problems, policies must focus on social, economic, and context-specific cultural factors, as well as ensure the availability and quality of data, IT, knowledge and governance resources, and business and citizens' collaboration. This is truly a daunting task.

The second paper, *Investment Uncertainty Analysis for Smart Grid Adoption: A Real Option Approach*, by Feng, Zhang, and Gao, provides an illustration of the growing trend in policy-driven electronic governance in digital government research. As a key component of infrastructure that enables smart cities and smart governance, smart grid has the potential to enhance living conditions and provide energy independent and low carbon economic growth for nations. Despite its long-term benefits, however, the implementation of smart grid has encountered considerable difficulties, and planning the transition in the energy infrastructure itself has become a wicked problem. It is imperative to incorporate uncertainty and complexity in understanding the adoption of such large-scale investments. Using Real Option Analysis as a tool to estimate the benefits and costs of such emerging technologies and incorporate elements of uncertainty, this paper provides an example of how ICT can be used to deal with various wicked problems in public planning, and develop policy recommendations based on simulation results.

In the third paper in this special issue, *Open Government Process and Government Transparency in Crisis Communication: The Case of AirAsia QZ8501 Crash*, Reddick, Chatfield, and Brajawidagda investigate the antecedents of the perception of government transparency in the aftermath of an aviation disaster. The context of a crisis is often characterized by hyper-unknown and hyper-uncertainty. Amid the uncertainty, governments need to respond immediately and decisively to retain legitimacy and citizen's trust. However, the authors note that factors that influence the transparency of government crisis communications remain understudied. Using a content analysis of news articles, the authors identified key factors that lead to positive perceptions of government transparency, including openness of the search and rescue process, management and structure, information quality, government leadership, and ICT use. Not surprisingly, perhaps, they found that the openness of the search and rescue process was the most salient antecedent of perceptions of transparency.

In light of the fear triggered by the recent outbreak of Zika virus, the fourth paper represents a timely investigation of a current wicked problem – containing deadly and transmissible diseases in the globalized world. *Wicked Problems in Real Time: Uncertainty, Information, and the Escalation of Ebola*, by Comfort, Bert, and Song, studies the escalation of Ebola outbreaks in West Africa. The authors discover that the wickedness of controlling deadly disease outbreaks manifested in a number of ways. For example, perfectly logical steps to curb the transmission often resulted in unexpected consequences; the requirements of cross-border, cross-jurisdiction, and inter-organizational collaboration exceeded individual organizations' capacities, and lack of communication and public health infrastructure limited the effectiveness of containment of widespread outbreaks. Most importantly, the interaction of these conditions – deadly disease, weak governance capability, and limited communication and health infrastructure, created a vicious cycle that fueled the escalation. This study illustrates that timely and valid information sharing in complex adaptive systems is critical to reduce misinformation and uncertainty, which in turn, serves as the basis for collective action. This study highlights the importance of information flow in managing this wicked problem.

The fifth paper focuses on the digital divide, the gap between those who have access to ICTs and the internet and those who do not. The digital divide is an unintended consequence of the wide adoption of

advanced ICTs in social, economic, political, and cultural realms. Sung's paper, *A Study of the Digital Divide in the Current Phase of the Information Age: The Moderating Effect of Smartphones*, attempts to determine whether the proliferation of smartphones has helped close the digital divide. Results from a Korea Media Panel Survey indicated that, because of their relative low price, ease of use, and multi-functionality, smartphone use has indeed reduced the gaps among several demographic groups. The paper suggests that policies that target the digital divide should seek to increase the accessibility of smartphones and encourage their extensive use.

The implementation of Enterprise Resource Planning (ERP) systems is complex, costly, and prone to failure. ERP implementation in the private sector has been the subject of research interest for the last two decades and has yielded a relatively mature understanding of the project management processes and critical factors. How applicable this understanding is to the public sector remains a question. The sixth paper, by Coelho and colleagues, *The Client-Consultant Relationship in the ERP Implementation in Government: Exploring the Dynamic between Power and Knowledge*, begins with the observation that models of project leadership and management commonly accepted in the private sector – e.g. resource allocation and risk management – might not be sufficient when ERP is implemented in the public sector. The authors indicate that the power/knowledge interplay between government and consultants must be considered seriously. The study identifies nine mechanisms of knowledge and power dynamics that influence this relationship, and the authors' insights offer ways to improve the relationship between governments and consultants in similar IS implementation projects.

Can ICTs serve as a tool to fight inefficiency, corruption, and other problems that afflict governments in developing countries? In their paper, *Citizens' Perceptions of the Impact of Information Technology Use on Transparency, Efficiency, and Corruption in Local Governments*, Valle-Cruz, Sandoval-Almazan, and Gil-Garcia describe the results obtained from survey data they collected in 2015 on citizens' perceptions of local Mexican governments. Although they found that technology supports interactions between citizens and government affected citizens' perceptions, the direction of the relationships is not conclusive. The authors found positive associations between the use of web pages and transparency, efficiency, and corruption perception. Social media also were associated positively with corruption perception, while mobile use had a negative association. No other technology media, such as email or free internet services, were found to affect citizens' perceptions significantly.

3. Contending with wicked problems

By definition, wicked problems are insoluble because there are no "right" or "optimal" solutions, and a given solution often triggers other problems that might be even more difficult to solve than the original one. Thus, we are confronted with the dilemma – damned if you do, and damned if you don't. Nevertheless, history has witnessed many "good vs. bad," or "better vs. worse" solutions. We believe that we should direct our attention and efforts to formulating "good" or "better" solutions, and we believe as well that the digital government research community is in a unique position to make a significant difference. To stimulate further research in this direction, we offer the following recommendations.

Acknowledging the wicked nature of digital government initiatives is the first step in addressing them. Since its onset, a great deal of digital government research has adopted critical and social-technical perspectives of the role of technological changes (e.g., [12]). For example, the largest clusters of research themes in the digital government domain were reported as "e-government enactment" (e.g., [13,14]) and "online trust" (e.g. [15,16]): see [11] for a summary of the bibliographic analysis). Thus, a large portion of digital government research is dedicated to these themes. Typically, these frameworks and research

focuses embrace a dialectic approach in their belief that technology change is embedded intrinsically in organizational, political, legal and social changes, in which many of those changes produce unintended and profound consequences (cf., [17]). This orientation is indeed one advantage of digital government research in approaching wicked problems. We recommend that the field continue to advance the sophisticated understanding of the interaction of ICT, government, and society with these traditions, and build a theoretical foundation that transcends technologies.

Formulating a wicked problem is a daunting task. Complexity can arise from many sources, one of which is the elusive and unknown nature of the problem. Digital government research might be useful if used to detect warning signs, identify key inputs and parameters, define problem and solution spaces, delineate untested assumptions and system constraints, construct performance measurements, and simulate how good a solution might be. Some of the developments in digital government are especially helpful in this respect, such as data-oriented decision-making, modeling and simulation, and policy informatics (e.g., [18]). We encourage more research that adopts as its central focus the task of understanding and formulating wicked problems.

Another source of complexity when faced with wicked problems is the ambiguous and equivocal nature of different constituents' objectives. Many stakeholders and interest groups are involved, and their values, ideological orientations, and practical interests tend to differ, which in turn, makes collective goal setting and problem formulation difficult, if possible at all. With the rise of interactive technologies, such as social media, we may have a better opportunity to identify citizens' sentiments, engage constituents earlier and more meaningfully, and explore decision paths through interactive dialogue and activities during which problems and solutions emerge gradually. We suggest that future research examine critically the potential and pitfalls of social media and other interactive technology in policy discourse and engagement.

We also would like to encourage more cross-disciplinary research that takes advantage of the unprecedented growth of data and analytical capability. The articles in this Special Issue used various approaches and examples to begin the conversation on the nature of wicked problems and provided potential lessons for managing them in digital government research. We have yet to see any substantial amount of research that has exploited the power of big data and computation simulations in digital government research in general [11]. Their application in other disciplines, such as health science, business, and computer science, has yielded valuable insights about some of the most intractable problems, such as finding a cure for cancer. Incorporating these new technologies and capabilities into digital government research could offer promising ways in which to grapple with wicked problems.

Rittel and Webber [2] underscored the fact that, to address them properly, planners need to recognize the wickedness of problems. They went a step further by suggesting that "it becomes morally objectionable for the planner to treat a wicked problem as though it were a tame one, or tame a wicked problem prematurely, or to refuse to recognize the inherent wickedness of social problems." Digital government research, although no longer in its infancy, remains an emerging discipline [5]. Thus, it is a fortuitous moment at which to ask that the field orient itself appropriately, in both its theories and practices, to address the problems of our increasingly complex and entangled world.

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