



Knowledge vacuum: An organizational learning dynamic of how e-government innovations fail

Taehyon Choi^{a,*,1}, Susan Meyers Chandler^b

^a Graduate School of Public Administration, Seoul National University, Seoul 08826, Republic of Korea

^b College of Social Sciences, Saunders Hall, University of Hawai'i at Mānoa, 2424 Maile Way, Honolulu, HI 96822, USA



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ABSTRACT

In spite of attempting to implement e-government innovations to enhance efficiency in public organizations for several decades, e-government innovation has often not met the expectations of citizens, legislatures, or the organizations. Although a wide range of causes from poor planning to improper implementation have been suggested for explanation of failures, it is still challenging to theoretically construct an explanation of what the overarching dynamic is behind those causes. To further develop the understanding of the conditions of unrealized benefits of e-government innovation, we propose a conceptual framework of a *knowledge vacuum*, which is an organizational condition in which excessive exploration and organizational inertia interact to create a vicious cycle of low performance. We first review the history of e-government and factors that affect the success and failure of e-government innovation. Next, we develop the conceptual framework, and apply the concept to review an e-government innovation failure case for an illustrative purpose. We conclude by discussing theoretical and practical implications of the conceptual framework and its limitations in understanding the current state of e-government innovations.

1. Introduction

The public sector has been attempting for several decades to implement e-government innovations in order to improve the effectiveness, efficiency, responsiveness and creativity in public organizations (Chen & Perry, 2003; Coursey & Norris, 2008; Moon, 2002; Wood, Bernt, & Ting, 2009). However, there are many cases of low performance and failures, and many examples of e-government implementation that have not met the expectations of citizens, legislatures, or the organizations (Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016; Askim, Christensen, Fimreite, & Laegreid, 2010; Holmes, 2005; Morgeson III & Mithas, 2009; Moynihan & Lavertu, 2012). When looking at the history of e-government innovations, scholars find that they have not been a well-planned, coherent movement; instead, they are rather fragmented attempts (Dawes, 2008) driven by different factors such as technological innovations, political pressure, or even precedent failures. New technologies as well as innovative information, management and communication approaches seem to provide optimism, but until recently scholars still remain cautious.

Causes of these broken promises have been investigated by scholars, from the planning to the implementation stage across the domains of

technology, management, regulation, and environment (Gil-Garcia & Pardo, 2005). Although the literature suggests which factors may help explain e-government success and failure, it is still necessary to design a comprehensive theoretical framework through which we can more systematically understand the relationship among causes of e-government success and failure. One venue to develop a theoretical framework is to elucidate the dynamic nature of e-government innovations through the learning perspective. Innovation research has been closely related to the organizational learning literature (Borins, 2001; Brown & Brudney, 2003; Cohen & Levinthal, 1990; Moynihan & Lavertu, 2012; Salge, 2010). Recent policy implementation research has also paid increasing attention to the role of organizational and social policy learning to better understand the dynamic of policy decisions, implementation and evaluation (Bennett & Howlett, 1992; Dunlop, 2017; Hall, 1993; Howlett, Ramesh, & Perl, 2009; May, 1992; Moyson, Scholten, & Weible, 2017). Both literatures emphasize that learning lies at the center of the dynamic aspect of the causes of innovation success and failure. That is, innovation is not determined to succeed or fail a priori when certain factors are found; instead, it depends on how public managers, politicians, and stakeholders effectively respond to the prior conditions and challenges emerging through the implementation

* Corresponding author.

E-mail addresses: taehyon@snu.ac.kr (T. Choi), chandler@hawaii.edu (S.M. Chandler).

¹ Permanent address of the author.

process. On the other hand, although this perspective is useful, the previous research on learning has emphasized mostly the positive dynamic of learning than the negative ones (Hall, 1993; May, 1992). Unsatisfactory performance of e-government innovation requires us to pay attention to the negative dynamic of learning to develop a complete theory of e-government innovation.

The purpose of this article is to suggest a conceptual framework of a *knowledge vacuum* that puts the learning dynamic at the center to understand e-government innovation failures. This framework is not intended to propose a counterargument against what has been found in the e-government implementation research; instead, this framework is intended to fill a particular theoretical need to explain the dynamic nature of innovation implementation through the lens of learning emerging in both the policy and the organization literature. The concept of a *knowledge vacuum* refers to an organizational condition in which the pushing force of innovation and the pulling force of organizational inertia both at the structural and behavioral levels such as political pressure, pro-innovation bias, and employee frustration, interact to create a negative spiral that hampers organizational and policy learning. In a knowledge vacuum, the structural changes impose the need for learning that exceeds the employees' capacity and motivation, resulting in their frustration and resistance, which in turn pulls back the organizational capacity for learning but at the same time stimulates additional changes to respond to the deadlock. The concept highlights the potential negative impact of complex innovations (Torugsa & Arundel, 2016), which is common these days, on organizational knowledge and innovation success.

In the following section we review the historical unfolding of e-government innovations to show that this innovation has not been a consistent and homogenous technological evolution but rather, a diversified change in technology, goals, governance and management. Next, we propose the conceptual framework of a *knowledge vacuum* by focusing on the internal dynamics between pushing and pulling forces at the structural and behavioral level. Then we provide a case analysis of a failed e-government innovation that illustrates how the conceptual framework can be applied to analyze an e-government case and fill a theoretical gap found in the innovation literature. Finally, we discuss the theoretical and practical implications of this conceptual framework and its limitations.

2. Adoption of e-government innovations: a review of the historical development of e-government

2.1. A short history of e-government innovations

E-government has been fueled by newly available information and communication technologies (ICTs) (Norris & Moon, 2005). Most scholars define e-government primarily by emphasizing its technology aspects. For example, West (2004: 16) defined e-government as "the delivery of [government] information services online via the Internet or other digital means." Similarly but more extensively, Wood, Bernt, and Ting (2009: 753) defined e-government as "the use of information technology to improve government performance, particularly in relation to issues such as access to information, service delivery, cost savings, and heightened citizen participation." Other scholars emphasize the interface between government and citizens (G4C), business (G2B), and government (G2G) and highlighted e-government as a "new face of government" (Morgeson III & Mithas, 2009; Thomas & Streib, 2003).

E-government innovations have been part of a greater historical and systemic attempt of government innovation to enhance the efficiency of public organizations and the quality of public service by using computers (Brudney & Selden, 1995; Kraemer & King, 1986), Internet (Kraemer & King, 2008), and later more advanced ICTs (Shaikh, 2016). Earlier scholars on e-government innovation particularly struggled with defining "public" management information systems (PMIS) and configuring how the technology-driven innovation in public organizations

is different from that in private organizations (Bozeman & Bretschneider, 1986; Bretschneider, 1990). Scholars also paid attention to the contextual aspect of e-government innovation within the broader administrative reform and innovation (King et al., 1994), and the effect of e-government innovation on organizational structure, process, and performance (Kraemer & King, 1986; Perry & Kraemer, 1979).

The practice of e-government is not a homogenous series of actions. E-government has conceptual siblings such as e-governance, e-participation and e-democracy that put a higher emphasis on citizen participation in public governance via ICTs (Garson, 2007). Dawes (2008: s87) identified five aspects in the historical development of e-government: a policy framework, enhanced public services, high quality and cost-effective government operations, citizen engagement in democratic processes, and administrative and institutional reform. These heterogeneous components of e-government demonstrate multifaceted goals and destinations of different e-government systems and the interaction between those systems and the institutional environment in which those systems are embedded. Dawes (2008) summarized the multi-branched historical development of e-government up to the late 1990s:

"Most early efforts were aimed at efficiency improvements and simplifications of paper-burdened processes, or they were modest attempts to put basic descriptive information online. ... Later, agencies began to experiment with Web sites where visitors could find documents and information about agency structures and programs. ... Subsequently, electronic services to citizens became the exemplar of e-government, focusing on electronic transactions in which individuals could actually conduct some kinds of business within government, such as paying fines or taxes, applying for a student loan, or renewing a driver's license. ... In the late 1990s, the adoption of the Web moved forward rapidly at all levels of government (s89-s90)."

More recently, e-government along with the emergence of Web 2.0 has evolved to incorporate Direct Recording Electronic (DRE or e-voting), e-commerce features, Public Participation Geographic Information Systems (PPGIS), e-discovery, Social Networking Services (SNS), and cloud computing (Bertot, Jaeger, & Grimes, 2010; Criado, Sandoval-Almazan, & Gil-Garcia, 2013; Ganapati, 2011; Morgeson III & Mithas, 2009; Moynihan & Lavertu, 2012; NASCIO, 2007; Paquette, Jaeger, & Wilson, 2010). These innovations during the 2000s particularly focused on more democratic, citizen-oriented, and user-friendly e-government services which reflect the Web 2.0 characteristics, and are still evolving fast according to the advancement of information technology.

As such, e-government should not be viewed as a unitary system of public management but rather, as evolving into different paths of development by the *combination* between ICTs and government services. Viewing the variation within the broad boundary of e-government in this way implies that the direction of the development of e-government systems is not a linear developmental process but a set of synchronous, while intertwined, processes. It also has implications for the strategies managers will use to efficiently work across organizational boundaries, in collaborations, in public-private partnerships and other new forms of governance (O'Toole, 2015).

In the following sections, we first review what drives e-government innovation and what affects the success and failure of e-government innovation to set the ground of the conceptual framework of a knowledge vacuum.

2.2. Antecedents of e-government innovation

2.2.1. Structural antecedents

Structural antecedents include environmental factors and organizational structure. First of all, the adoption of e-government was part of a more encompassing step toward government innovation in accordance with New Public Management in the early 1990s in the United

States (Chen & Perry, 2003; Dawes, 2008). Technological development is another structural push toward e-government innovation (Damanpour & Aravind, 2012). The innovations in e-government systems including the establishment of government Web sites, e-voting systems, public GIS system, and social network pages were all enabled and driven by the new technology made available. Especially, the pro-innovation bias found among public managers is often fueled by the availability of new technology (Damanpour & Aravind, 2012).

Scholars have paid attention to the level of government (federal, state, and local) (Morgeson III, 2013; Scott, 2006), the size and economic condition of the jurisdiction of public organizations (Tolbert, Mossberger, & McNeal, 2008), and the pressure toward isomorphism within the public sector (Jun & Weare, 2010) as composing the organizational context of innovation. Slack resources were also related to the innovation adoption in the public sector (Salge, 2010). Some scholars also paid attention to the nature of bureaucracy on innovation in general (Welch & Pandey, 2006), and found mixed results. Public organizations have not faced pressure to generate citizen demands on e-government services (Bertot et al., 2010; Streib & Willoughby, 2005; Wood et al., 2009), while others identified it as an important factor (Brown & Brudney, 2003).

2.2.2. Behavioral antecedents

Behavioral antecedents include cognitive and behavioral inclinations of an organization's senior-management team, the managers' risk aversion/taking tendency, and employees' perception of the change (Lavie, Stettner, & Tushman, 2010). Research has found that there is an important influence that the managers play (Borins, 2001) as well as structural factors. The focus of managerial attention and manager characteristics has also been found to be a factor (Damanpour & Schneider, 2008; Ocasio, 1997). Borins (2000, 2001) found that middle managers and frontline public servants play the role as innovators in response to internal problems or opportunities. At the same time, however, Wood et al. (2009: 755) pointed out many barriers to innovation at the behavioral level, summarizing "employee resistance to using information technology (Ho & Ni, 2004), maintenance burdens (Eschenfelder, 2004), failure to evaluate efforts (Chen & Knepper, 2005; Specht & Hoff, 2005), and agencies not actively identifying the preferences of government Web site users (Scott, 2006)." Overall, the effect of behavioral factors seems to be ambivalent; they can work as both pushing and pulling factors for e-government innovation depending on the context in which public managers and employees are located.

2.3. Implementation factors of e-government innovation

Many studies have reported mixed but generally low performance of e-government systems (c.f., Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016). Morgeson III and Mithas (2009) reported that the federal government's Web sites are still lagging behind their counterparts in the private sector, although they have shown great improvement in the quality of the content. In addition, Moynihan and Lavertu (2012: 68) argued that while the adoption of new information technology is a central theme of contemporary governance, new technologies have a spotty record of performance (Garson, 2006; Goldfinch, 2007). Waters and Williams (2011) found that contrary to practitioners' claims of interactivity on Twitter, communication between government agencies and citizens was still unidirectional for informing and educating. Similar findings have also been reported more recently (Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016; Criado, Sandoval-Almazan, & Gil-Garcia, 2013).

A lot of factors that affect the success and failure of e-government innovation have been suggested by scholars. In an extensive review at that time, Gil-Garcia & Pardo, 2005 listed 22 challenges and 23 key success strategies for e-government initiatives in five categories of information and data, information technology, organizational and managerial, legal and regulatory, and institutional and environmental.

These include usability of the technology, technological incompatibility, technology newness and complexity, a manager's attitudes and behavior, multiple or conflicting goals, resistance to change, policy and political pressures, and multiple or conflicting goals. They also emphasized clear and realistic goals, planning, good communication, adequate training and funding, and leadership support from executive and legislative branches. In a more recent review, Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016 identified e-government project failure reasons and factors such as design-reality gaps, missing focus, skill issues, unrealistic schedule and planning, politics, education, unclear vision, and system development process. It is notable that both studies have in common environmental pressures, weak leadership and planning, lack of training and funding, unclear or complex goals and IT systems are key factors of success and failure.

2.4. Summary

Putting the antecedents and implementation factors altogether, these factors could be understood in a more comprehensive way. For example, poor planning and leadership support, lack of resources, and stumbling implementation may not come alone but stimulate another in different ways; poor planning could be overcome by prudent public managers or increased resources; conversely, even well-designed planning may not be supported by appropriate implementation or face employee resistance. Behind these hypotheses lies a theoretical concern of how these factors are related with one another. In this article we intend to develop a theoretical framework with regard to how these factors are intertwined to mutually strengthen or soothe each other by more fundamental organizational forces. From this perspective, we propose a conceptual framework in which the interplay among these factors is highlighted for further theory development.

3. Conceptual framework of a knowledge vacuum in e-government innovation

3.1. Overview of the concept

In this section, we propose the conceptual framework of a *knowledge vacuum*,² focusing on its internal dynamics. As suggested in the introduction, the concept of a knowledge vacuum highlights the interaction between diverse structural and behavioral factors toward a negative, rather than positive, direction. Those structural and behavioral factors create either pushing forces toward exploration, which is defined as "search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation (March, 1991: 71)," or pulling forces against it. While innovation pushes an organization into a new area in which employees are not equipped with an adequate level of knowledge, pulling factors force the organization to remain within the previous boundary in which employees are well trained and feel psychologically safe. The difference between the knowledge required after innovation and the knowledge currently available can be frustrating to employees. Although many of those factors have been identified in the policy implementation literature as reviewed above, what has not been fully discussed in the literature is that the tension between the pushing and pulling factors are intertwined at both the structural and behavioral levels and are likely to generate a significant deficit of knowledge.

Before discussing the dynamic in detail, it is worth discussing how the concept should be distinguished from a usual learning process or a mere knowledge gap. First, while a knowledge gap occurs naturally in

²The authors developed the term *knowledge vacuum* to reflect the theoretical idea discussed in this article. As far as the authors' exploration of the academic literature, the term *knowledge vacuum* has rarely been used academically, except for a few practical uses of the term to refer to the effect of employee retirement or turnover on organizational knowledge.

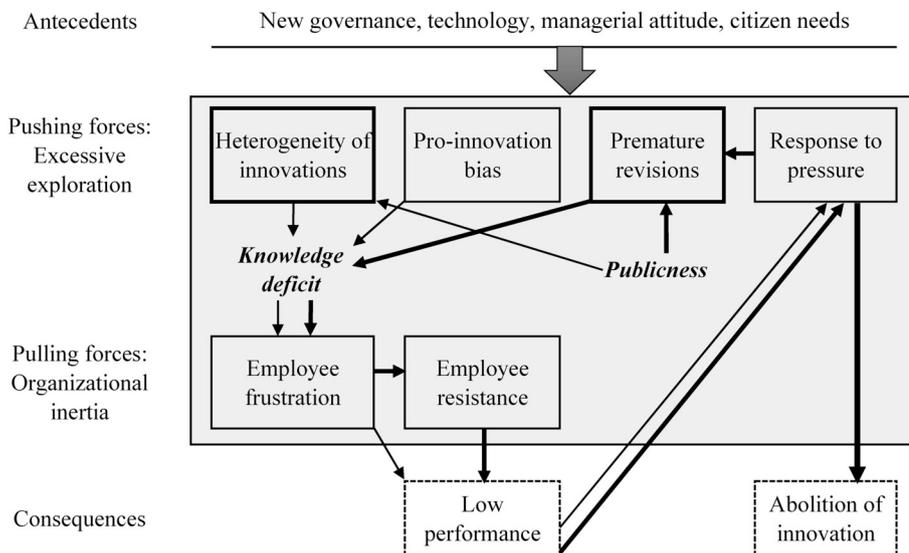


Fig. 1. The conceptual framework of a knowledge vacuum.

Note. The grey area indicates the vicious cycle dynamic of a knowledge vacuum. The thick-lined boxes indicate structural factors; the real-lined boxes indicate behavioral factors. The thin arrows indicate the usual early stage failure while the thick arrows indicate the dynamic of the vicious cycle.

the short term when a new innovation is attempted, a knowledge vacuum can occur when more than one innovation is attempted sequentially or simultaneously so that the task complexity increases beyond the absorptive capacity of the organization and employees (Cohen & Levinthal, 1990). Second, while a knowledge gap would disappear during the natural operation and by training and education (Damanpour, Walker, & Avellaneda, 2009), what would be considered a knowledge vacuum persists for a longer time. Third, while an organization can improve its performance up to the expected level after filling the knowledge gap, organizations in a knowledge vacuum cannot provide signs of a politically acceptable level of performance improvement.

Fig. 1 summarizes the conceptual framework of a knowledge vacuum with regard to the dynamic through which a knowledge vacuum can occur. First, the antecedents of a knowledge vacuum include heterogeneous new governance reforms, technological development, managerial attitudes, and citizen needs (Dawes, 2008; Osborne, 2006). Second, the pushing force of excessive exploration is formed by the heterogeneity of the e-government innovation and premature revisions at the structural level, along with public managers' pro-innovation bias and premature responses to political pressure at the behavioral level. Third, the pulling force of organizational inertia is formed mainly by employee frustration and resistance, mediated by a knowledge deficit in the middle of the pushing and pulling forces. The arrows indicate the dynamic relationship among factors. Fig. 1 illustrates that low performance stimulates political pressure, which incurs premature revisions, triggered also by being a public organization. This process further enlarges the knowledge deficit and employee frustration and resistance, and then may result in even lower performance. The vicious cycle (indicated by thick arrows) may either continue or end with the abolition of the innovation at some point. We discuss the theoretical components in Fig. 1 in more detail in the following sections.

3.2. Pushing forces: excessive exploration

3.2.1. Heterogeneity of innovation

One driving force of a knowledge vacuum is the heterogeneity of innovation. The heterogeneity of e-government innovation stems from governance in general and e-government implementation specifically. First, for the last four decades, public organizations have been involved in heterogeneous administrative reforms that mix the hierarchical, market-oriented, and community-based governance systems with new technology including new public management, participatory and deliberative governance, and the development of e-government strategies

(Ansell & Gash, 2008; Dunleavy, Margetts, Bastow, & Tinkler, 2006; Osborne, 2006; O'Toole, 2015). These innovations do not necessarily pursue compatible goals; as Osborne (2006) summarized, innovations emphasize goals such as legal accountability and responsiveness, and efficiency and participation, which are frequently argued as conflicting. In addition, the adoption of heterogeneous governance innovations has brought different types of technology, managerial practices, and stakeholder inclusion with a significant level of variance in performance. E-government innovations have been part of these heterogeneous general public sector innovations.

Another source of heterogeneity of e-government innovation is its own multidimensionality. We can typify different efforts of e-government: technological exploration, structural exploration, and domain exploration (cf. Damanpour et al., 2009; Lavie et al., 2010; Walker, 2008). Technological exploration occurred when public organizations tried to adopt new ITCs available from e-mails in the early 1990s to today's cloud computing and open data. Structural exploration occurs when public organizations establish new positions or organizational divisions for ICT within the organizational boundary or choose to contract out the e-government development, functions and maintenance to the private sector. Finally, domain exploration occurs when public organizations seek to expand the content and service of e-government from office automation to, for example, Web site development for information provision and sharing, and to e-participation to receive feedback on regulations and rules from citizens. These three types of exploration are conceptually independent, but in reality they come hand in hand as we discussed in the previous section as the unique feature of e-government innovation that involves policy frameworks, enhanced public services, high quality and cost-effective government operations, citizen engagement, and administrative reform (Dawes, 2008: s87).

3.2.2. Pro-innovation bias

At the behavioral level, the managers' faith in technology or 'pro-innovation bias' (Damanpour & Aravind, 2012) was found to be an important factor that facilitated the adoption and further innovation of new e-government systems (Moynihan & Lavertu, 2012). With the bias, innovation in both public and private organizations is often adopted simply in the pursuit of legitimacy rather than performance (Ashworth, Boyne, & Delbridge, 2009; Walker, Damanpour, & Devece, 2010; Wang, 2010). These behavioral pushing factors are well connected with causes of e-government failures such as design-reality gaps and poor planning (Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016; Gil-Garcia & Pardo, 2005).

3.2.3. Political pressure and premature revisions

Another pushing force of a knowledge vacuum is prematurity of revisions. The adoption and implementation of comprehensive e-government systems in the public sector, particularly in a relatively very short period of time, raises a theoretical concern of premature revision. First, the outcomes of this innovation may not have been appropriately evaluated. Jun and Weare (2010), while reporting relatively low performance of government Web sites and e-government systems, questioned whether it was too early to accurately measure the benefit of e-government systems given it was just less than twenty years since American government widely adopted e-government systems. In addition, Wood et al. (2009: 755) argued:

“a fair question might be whether some ideals, such as notions of cyberdemocracy and citizen empowerment, set the bar too high for e-government, especially given what some regard as the relatively incipient nature of e-government (e.g., Yang & Paul, 2005) or the complexities of policy implementation more generally (Hill & Hupe, 2002).”

These questions are well taken, in that the benefit from innovation is usually remote in time and uncertain (Klein & Sorra, 1996; March, 1991; Salge, 2010). At this point, the structural aspect of premature revision is linked with a behavioral response to political pressure. Since the benefit of serious exploratory learning is not noticeable in the short run, requiring performance outcomes to be documented too quickly might motivate politicians and public managers to explore other options prematurely and trigger the vicious cycle of even more exploration and subsequent failure (Borins, 2000; Levinthal & March, 1993; Salge, 2010). As we discussed with regard to the antecedents of e-government innovation, politicians and public managers do not have the luxury of waiting and doing “nothing” under pressure even when it may be the best strategy (Askim et al., 2010; Rittel & Webber, 1973).

3.2.4. Publicness: a moderator

The two pushing forces of e-government innovation are associated with the publicness of organizations in the public sector. Bozeman and Bretschneider (1994: 199) distinguished two pillar approaches to the issue of publicness: “a core model based on ownership” and “a dimensional model based on external political authority,” and defined publicness as “a characteristic of an organization which reflects the extent the organization is influenced by political authority” (Bozeman & Bretschneider, 1994: 197), which still remains an influential understanding of publicness. In their article about PMIS, Bozeman & Bretschneider, 1986 suggested four models of publicness: economic authority, political authority, work context, and personnel and personnel system. They emphasized as the content of publicness the lack of economic incentives due to the lack of ownership exchange, weak links between work input and reward, the strong external political control mechanism that is related to short time frame and pace of work, and goal ambiguity that results in the formalism in employee behavior. That is, an organization with high publicness would face little market pressure but much political – rather short-term and constant – pressure, goal ambiguity and low employee motivation. This variety of characteristics of publicness is particularly related to the dynamic of a knowledge vacuum in the following manner.

First, with regard to heterogeneity of innovations, goal ambiguity is a huge challenge in the public sector (Chun & Rainey, 2005; Pandey & Rainey, 2006). Specifically, the adoption of a new e-government system usually seeks many more and complex goals compared to organizations in the private and commercial sector (Morgeson III & Mithas, 2009). This condition of goal diversity and ambiguity is known to incur poor implementation by overwhelming public managers with divergent and conflicting paths that need to be pursued (Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016; Gil-Garcia & Pardo, 2005). Goal ambiguity can provide soil for excessive exploration when politicians or public managers are highly motivated (or pushed) to adopt yet another,

and new ICTs.

The vicious cycle of premature revision can also be triggered due to another characteristic of public organizations; they rarely disband. Although it is logically plausible for private organizations to fall into this vicious cycle, it is difficult to find a case of a private organization that remains in a situation of a failed innovation for a long time because such organizations simply would not survive. Public organizations, however, rarely disband solely because of low performance. Therefore, the driving force of premature revisions is more likely to be found in public organizations than in private ones. As a result, a knowledge vacuum is more apt to emerge when the conditions unique to public organizations are met beyond the cases of e-government innovation; however, e-government innovation is more likely to meet the conditions than any single, short-term administrative, process, or product innovation.

3.3. Pulling forces: organizational inertia

While the pushing force is related to heterogeneous and premature innovations with a pro-innovation bias and political pressures, the pulling force is mainly related to the organizational inertia that resists change. Scholars recognize that public organizations show ambivalent motivations to innovate from the inside (Gains & John, 2010) and political pressure from the outside that pushes public organizations to innovate sometimes against their will with low motivation and high levels of inertia. In other words, at the behavioral level, although political pressure or public managers' pro-innovation bias pushes public organizations toward innovation, there might not be adequate responses from employees mainly due to motivational and cognitive reasons (Eschenfelder, 2004; Gillingham, 2017; Ho & Ni, 2004).

Public employee resistance occurs when new systems distract public employees from their main task of serving clients toward spending too much time on “bureaucratic” work, such as inputting data or managing IT systems (Eschenfelder, 2004; Pithouse et al., 2012). Although public servants' resistance to government reform is well known (Ho & Ni, 2004; Wood et al., 2009), the concept of a knowledge vacuum emphasizes the cognitive burden imposed on them as the cause of such resistance. The cognitive burden of newly adopted e-government systems has been well studied in the field of social work (Gillingham, 2017; Gillingham & Humphreys, 2010; Mouloudi, Morizet-Mahoudeaux, & Valentin, 2011). In this field, employees of government and non-profit organizations are reported to feel frustrated when a new ICT is adopted. For example, scholars found that social workers complained about a new system because they had to spend a significant amount of time learning the new system and inputting information about their activity, while not knowing or fully understanding how the whole system worked (Pithouse et al., 2012). Such innovations were rarely perceived as beneficial to their work and often seen as making it harder to provide the high quality, direct services they wanted to provide for clients. The cognitive burden of learning does not simply apply to public employees but also citizens or clients of the public service when they need to learn about a new interface and must deal with new on-line requirements of a new e-government system instead of face-to-face service (Pithouse et al., 2012). When public employees feel that they have lost control of the process and are not able to follow the new ICT requirements, their frustration may reduce their motivation to abide by or implement the innovation. As indicated in Fig. 1, this employee frustration constructs a loop toward further resistance to the changes. Paradoxically, the frustrated behavior and its consequence from the employees' side in turn may boost, not drag, the vicious cycle of premature revision at the structural level by leaders who face political pressure.

3.4. Consequences of a knowledge vacuum

Consequences of a knowledge vacuum are more than low

performance. When a knowledge vacuum occurs, it implies that the e-government innovation is already in a vicious cycle in which appropriate performance measurement is out of consideration. An adoption of an e-government system is so conspicuous and symbolic that it is likely that a political response to the failure of an e-government innovation is to repeat unpromising follow-up innovations or desperately abolish the whole innovation. The former would only drive the premature revisions even further, resulting in strengthening the knowledge vacuum; the latter would stop the vicious dynamic of the knowledge vacuum with significant organizational costs.

4. A case of attempted e-government system innovation

In this section, we provide an analysis of one state's attempt at e-government innovation and its failure. The illustrative case is about an attempt to update and revise eligibility determination, enrollment, billing and accounting systems inside Hawai'i's Medicaid program. The case analysis intends to weave program and policy implementation with several failure factors seen through the conceptual framework of a knowledge vacuum. The case is informative in that the agency suffered from a knowledge vacuum, and despite a long time lag in between two different attempts, little organizational learning took place. The data on the history and details of the case were collected from several Legislative Audit Reports of the Department of Human Services (1996, 2007, 2015) in the State of Hawaii as well as through media coverage.

4.1. History of heterogeneous innovations

In the late 1990s, many states in the U.S. experimented with e-government and other IT innovations as a part of the significant reforms in their Medicaid programs. The change occurred as state agencies were granted Medicaid Waivers and permitted to switch from a traditional fee-for-service health insurance system to a managed care approach (Holahan, Evans, Zuckerman, & Rangarajan, 1998; Kim & Jennings, 2012). Most states wanted to do this, as it was intended to result in significant cost savings and add flexibility to the program. This challenge, as is usual among e-government innovations, required extensive changes to the Medicaid agency's information systems, including the eligibility processes; client enrollment processes into new managed care health plans; new federal and state reporting requirements; new quality control mechanisms; new fiscal and accounting management systems and new reimbursement structures for the providers as summarized in Table 1.

The Department of Human Services (DHS) attempted to develop and implement a new management information system to replace its existing Medicaid Management Information System (MMIS). The Department contracted with Unisys, a company that had extensive experience working in the public sector and had successfully developed new IT systems in other states. However, as stated in the Legislative Audit of the QUEST³ Demonstration Project, Report No. 96-19 (Office of the Auditor, December 1996: 22), "the project... failed to develop the required management information system, and despite the importance of the system, the department [was] not even close to completing the [new] system." The Department terminated its contract with Unisys in its first year. It chose then to contract with the State of Arizona's existing Health Care Cost Containment Systems Administration (AHCCCS) to implement a new MMIS based on Arizona's system architecture.

In 2015, a new administration attempted another Medicaid reform initiative. The intent was to contract with an external provider, this time KPMG, to create a simple, real-time, on-line eligibility and enrollment process for the new Patient Protection and Affordable Care Act

(Obama Care). This innovation had an additional level of complexity to it as the DHS needed to obtain wage data from its sister agency, the Hawai'i's Department of Labor and Industrial Relations for eligibility verification. After client eligibility was determined, the IT system was expected to compute the cost and appropriate subsidy amount for the plan chosen by each individual or family. Simultaneously, the DHS also wanted to develop another IT system reform that would merge its two other income-based programs, the Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance to Needy Families (TANF) into the Medicaid data base. From the perspective of a knowledge vacuum, these all-encompassing pro-innovation attempts in response to the launch of Obama Care created a huge pushing force that would contribute to the emergence of a knowledge vacuum through the process described below.

4.2. The dynamics of a knowledge vacuum

The case described here highlights how a knowledge vacuum may have contributed to explaining the eventual failure of this innovation. The push for excessive innovation and the pull of the inertia of the Medicaid divisional leadership's resistance, created a negative spiral that led to organizational failures to implement the reforms. On one hand, the case documents many of the structural and behavioral elements described in the knowledge vacuum framework: heterogeneity of the innovations, a pro-innovation bias of the leadership, goal ambiguity, and extensive external political and advocate pressure. As the reform initiatives went on, on the other hand, employee frustration emerged and became quite public, employee resistance grew, and the service delivery system stalled. As such, structural and behavioral factors formed a positive feedback loop to create a knowledge vacuum and eventually the innovations were halted.

4.2.1. Growing knowledge deficit

It is important to note that Medicaid is an extremely complex program with shared funding between the federal and state governments. A huge number of exquisitely complex rules control what type and array of health care services will be reimbursed by the federal government including what type of health care provider can be reimbursed and at what cost. In any innovation reform attempt, there are many heterogeneous, and at times, seemingly competing goals that need to be accomplished. This is most commonly found in public organizations (Bozeman & Bretschneider, 1986; Chun & Rainey, 2005; Morgeson III & Mithas, 2009). For example, the 2015 DHS innovation plan was to offer eligible individuals a choice among different, private health insurance plans. However, the plans had different coverage levels as well as different costs, co-pays, possible subsidies and tax credits, all to be obtained through the new on-line marketplace (Consillio, 2015: 1). This new system also included a newly designed, electronic data system intended to ease the paperwork burden on the applicants applying for Medicaid. If the applicant was determined to be eligible, he or she was to seamlessly enroll in one of the several private health insurance plans being offered on the state's Health Connector. Finally, the system was to improve the agency's staff's ability to expedite enrollment, be more efficient and improve client service.

However, it seems that a knowledge vacuum emerged. The innovation caused a significant gap between the optimal level of knowledge about the innovations being planned for and the new policies being developed within Medicaid (and the other sister agencies) that needed to be involved and the existing level of knowledge within the Medicaid division's staff. In spite of the signs of this knowledge deficit, the legislative auditor found that the Medicaid division did not provide adequate systems staff to support the design and development of the new information system (Office of the Auditor, 1996, 2015). The lack of staff and internal expertise, which might not have been a problem with less radical innovations, impacted on the organization's ability to complete the design and installation of the system. The first contractor,

³ QUEST stands for Quality Care, Universal Access, Efficient Utilization, Stabilizing costs and Transforming the way health care is provided. It is the name of Hawai'i's Medicaid program.

Table 1
Challenges with regard to the e-government innovations in the medicaid programs.

Type of challenges	Specific challenges
Heterogeneity of newly adopted/modified systems	<ul style="list-style-type: none"> ● Eligibility systems ● Complex enrollment systems ● Extensive reporting requirements ● Quality control mechanisms ● Fiscal and accounting management systems ● Multiple reimbursement structures ● Working with new partners
Premature revisions	<ul style="list-style-type: none"> ● The first effort was the first time that a large management, information system contract was contracted out to a private company by the Department of Human Services. ● Staff did not have adequate skills in procurement of such a complex contract. ● Existing information and policy staff was inadequate. ● The second effort tried to implement too many changes too quickly. ● Politicians and stakeholders' pressure due to uncontrollability ● Hasty attempts to find evidence of improvement ● Early termination of the contracts
Cognitive burdens to public employees and customers	<p>Fiscal and accounting system adjustment</p> <ul style="list-style-type: none"> ● Medicaid program funding split between the federal and state government ● Need to understand the details of different health care service coverage options ● Different health care provider eligibility of reimbursement ● State autonomy while federal approval of all elements of the program for reimbursement ● Discrepancy between state spending and reimbursement coverage ● Requirement for precise and accurate documentation of costs ● Fear of making a mistake and risk losing federal reimbursement <p>Technology acquaintance</p> <ul style="list-style-type: none"> ● Enormous time and training requirements for extremely complex system integration ● Performing the following tasks through the new system: <ul style="list-style-type: none"> ○ Providing the interface with the new corporation and their computer systems ○ Developing relationships with the new health care plans ○ Complex and evolving federal requirements ○ Insuring health care service quality ○ Responding to consumer/recipient questions

Unisys wrote to the Department early in their first contract year, that they were concerned about the size and capacity of the DHS systems unit that was available to work on the project. The audit report (1996: 23) stated that Unisys was concerned that the QUEST Information System is “brand new and is an extremely complex system.” Unisys admitted that the timeframe was extremely optimistic and meeting it was “impossible and unrealistic” (Office of the Auditor, 1996: 23). A later audit (Office of the Auditor, 2007) concluded that the QUEST management information system development had been inadequately planned for. However, the problem was beyond the issue of just an unrealistic time frame that perhaps could have been corrected; there were more serious effects on the employees' behavior that made the negative effect persistent.

4.2.2. Employee frustration and resistance

There were difficulties at the behavioral level to this attempted reform due to the heterogeneity and numerous systems that were to be modified at the structural level. There was a strong pushing force of a pro-innovation attitude to implement this reform in order to save millions of dollars for the state. However, the agency also wanted to make these changes in a manner agreeable to the over 160,000 existing Medicaid consumers, the thousands of medical providers, plan administrators and the public sector employees. In several of the legislative hearings, many of the stakeholders reported that they were not being sufficiently included in the discussion nor were their comments being seriously considered during the planning and implementation stages of the new reform efforts.

The multiple-systems innovations were extremely demanding for the existing Medicaid staff which worried about an increasing knowledge deficit. For example, several of the Medicaid eligibility workers complained to their legislators as well as to the Office of the Auditor that during the testing phase, the new IT system just “didn't work.” They reported that the system sometimes generated inappropriate

notices, or requests for information that the worker had already entered into the system; different functions sometimes worked one day but not the next day and the functionality issues varied from case to case (Office of the Auditor, 2015). This led to the eligibility staff worrying about being able to maintain their highly touted accuracy levels in eligibility determination. The error rate in Hawai'i was extremely low and each eligibility worker felt responsible for his or her cases. Errors could result not only in lost reimbursement from the federal government, but errors could delay access to health. The employees were frustrated for being held responsible for mistakes they were not making, which led to an overall decrease in morale.

In hind site, another implementation issue that led to employee frustration and resistance became apparent. Although the number of changes being suggested in this reform seemed to be beyond the absorptive capacity of the employees to implement, the state legislature did not provide enough additional funding for the necessary training of the DHS staff or create sufficient new positions to insure a successful implementation. The legislature also mandated very short time lines on the implementation and put unrealistic expectations on the Medicaid agency to complete their tasks. Moreover, each year, the federal government changes Medicaid rules and regulations. These new and often complex tasks must be learned and implemented accurately by the Medicaid staff. A new management and information system on top of changing client eligibility and enrollment tasks is likely to be quite arduous for the staff. The stress that all these structural elements were likely to have imposed on state employees was a huge intellectual burden.

As a result, the new IT systems reforms faced resistance from a variety of crucial sectors: from state employees in all affected divisions (i.e. the Medicaid eligibility workers and the enrollment staff; the quality control officers; the fiscal and auditing workers; and the program monitoring staff); from the public sector unions that worried that staff might be laid off if a new IT system could do eligibility

determinations; from the health insurance companies that were being asked to adjust their information systems and provide additional, and from their perspective, burdensome and proprietary data to the state; from doctors and other health care providers who didn't want more paper work in order to get reimbursed; and from the Medicaid consumers who were fearful that they could lose their choice of provider. It is not surprising that this variety of resistance led to political pressure on the decision makers, which fueled the vicious cycle of the knowledge vacuum.

4.2.3. Acceleration of the knowledge vacuum

As indicated in Fig. 1, the malfunctioning of the systems triggered the loop of the accelerated response to political pressure and premature revisions. Given the newness and extensiveness of these e-government revisions, workers in the Med-Quest division frequently were required to respond to consumer/recipient questions and demands for information, as well as to interact with health care providers and insurance companies that all wanted to understand how the elements of reform would affect them. The agency staff believed they had insufficient information about the details of the innovations being planned for, and they worried that they lacked the capacity to assist stakeholders in the proposed transition.

As consumer complaints increased, the state began demanding more oversight of the Medicaid program and quickly became impatient with the lack of demonstrated success. Legislators began conducting monthly public informational hearings, asking questions of the staff and the contractors, which took valuable time away from the work needed to implement the changes. When answers were not forthcoming about the contractor's progress, and inevitable delays occurred, both internal and external stakeholders began to lose faith that the innovation would ever be successful. The local newspaper, the *Honolulu Star Advertiser* (March 3, 2015), wrote a story about this latest e-government failure.

"There was some kind of glitch in the system. They (DHS) really won't own it, and they won't do anything about it to make it right," Senator Baker said. "The director of the Medicaid division basically said 'It's Kaiser's fault' [one of the health insurance plans].... There are a number of legislators who have asked DHS to fix it and correct it, and as far as I know, they have been unresponsive to fixing the problem."

This kind of public criticism negatively affects state employees' behavior by demoralizing the DHS staff and leading to further frustration among the employees who felt that they were being blamed for the IT failure. State workers frequently complained that their leadership tries to implement new e-government or information systems too quickly and without sufficient input and inclusion from the workers who really know and understand the administrative and technology requirements. Workers often feel that they do not have sufficient time to learn about the new requirements and policy changes and they often believe that there were better ways to exploit their existing systems without continuously exploring new and different ways from outside companies and consultants. Many stakeholders are vocal in demanding improvements, and are impatient with the time it takes for system changes to get fully implemented; however, many state departments are plagued with old, legacy computer systems that are expected to handle new and more complex requirements being introduced either by the federal or state government. Eventually a vicious cycle of a knowledge vacuum, mediated by this mutual frustration, was accelerated.

4.3. Consequences

With pressure building to see documented performance outcomes, and perhaps setting up unrealistic expectations that the innovations weren't happening fast enough, the abolition of the innovation occurred abruptly as the state terminated their purchase of serviced contracts, returning some of the work back to the state agency and re-procuring

other parts of the information and computer processing tasks. The first time, DHS ended the contract and bought another state's entire ICT system. The second time, the state acknowledged that it was out of compliance with the Affordable Health Care Act after spending \$204.3 million in federal startup funds to design a state-based health insurance exchange. Hawaii's Health Connector, a nonprofit entity created and funded by the state legislature, was unable to resolve the complex technology issues and could not design a successfully integrated system with the Medicaid program. To date, the Department has not succeeded in integrating these programs with its Medicaid eligibility system. The legislative audit report noted that the "Med-Quest Division did not properly plan for or implement KOLEA.⁴ Poor planning and lack of effective leadership at the division level exacerbated already tight time constraints ..." (Office of the Auditor, Report #15-20 (2015: 1).

5. Discussion

5.1. Knowledge vacuum: analytical insights derived

The concept of a knowledge vacuum helps to integrate the causes of implementation failure by depicting the innovation process as the interaction between pushing and pulling forces. The concept of a knowledge vacuum has two important contributions. First, it can show that at the basis of many factors of implementation failure lies a lack or barriers of appropriate learning. Although learning is not a sole factor of e-government failure, it can highlight a comprehensive organizational landscape of why failure occurs. For example, in the case described, such factors as training, political pressure, a pro-innovation bias without careful planning, a lack of resources, and employee resistance, which the Audit Reports identified as factors of failure, are all integrated into the framework as serving to create a knowledge vacuum. During an innovation that is perceived as successful, the pulling forces may hamper the process only temporarily and organizations eventually catch up with the changes. In the case discussed previously, the organizational dynamic didn't work to the direction in which different factors were balanced to cure the negative effect of others but incurred a positive feedback loop that amplified the negative effect of the factors. The concept of a knowledge vacuum depicts a situation in which both pushing and pulling forces reinforce each other to the divergent direction.

Second, the conceptual framework also highlights the relationship between structural and behavioral factors. Reflecting a new institutional approach that emphasizes the structuring relationship between structure and behavior (Hall & Taylor, 1996), the conceptual framework shows how structural causes such as heterogeneity of innovation would affect public employees' behaviors, and they in turn affect the structure. The case analysis shows when we use learning as a key dynamic of an innovation, the implementation failure factors at the structural and behavioral level can be integrated to mutually reinforcing the innovation process. Furthermore, the framework also suggests that the relationship does not necessarily take a linear path toward success or failure; instead, the relationship generates a feedback loop.

The conceptual framework does not intend to provide a general theory that would explain all e-government innovation cases, whether successful or failing. First, a knowledge vacuum is not an inevitable consequence of the simultaneous and continuous implementation of multiple innovations. Empirical research has reported when technological and administrative, product and process innovations are adopted with an adequate sequence, organizational performance can be improved (Damanpour et al., 2009; Walker et al., 2010). The concept of a knowledge vacuum fits better in explaining the possibility of a vicious cycle of an organizational dynamic that would lead to a failure in e-

⁴ Kauhale On-Line Eligibility Assistance Application Project. Kauhale is the Hawaiian word for home or village.

government innovation implementation. Second, in the framework, any cause does not assume a decisive effect on the success and failure of e-government; instead, it is how the causes are arranged from the perspective of learning that matters. This approach may add theoretical flexibility, but also ambiguity; an e-government success and failure remains a matter of complex interplay among factors.

5.2. Practical implications for action

Can a knowledge vacuum be mitigated? In usual cases, organizational learning in the form of revisions or additional innovation is expected to lead to performance improvement (Argote, 2013). So, from a practical perspective, a relevant question is how public managers can mitigate the negative effect of a knowledge vacuum and turn it into a productive cycle of learning. While more research is necessary to empirically test these factors, the following managerial strategies can be derived from the conceptual framework and the case analysis.

First, as for the behavioral pushing factors, the concept of a knowledge vacuum highlights two things: self-awareness of public managers' pro-innovation bias, and a professional ethic to resist pressure-driven premature revisions and provide a realistic time frame. Although public organizations are usually facing "pace accelerators" (Bozeman & Bretschneider, 1986: 479), innovation strategies should insure that there is sufficient time to implement an innovation and resist unrealistic expectations to alleviate the negative triggering of pro-innovation bias. Agency leaders need to more carefully consider the multiple impacts of innovations on the workplace. Often a second innovation may be tried to "fix" the first one only compounding the problem. Under certain conditions, refinement rather than innovation may generate better performance (March, 1991), but the former often requires policymakers to make ethical decisions of refraining from another experiment against political pressure.

Second, as for the heterogeneity of innovations, policymakers need to consider simplifying the elements of the reform initiative and if necessary, "chunk" the project into small parts and/or implement it as a series of pilot projects. Understanding that a large and complex innovation will take significant time and effort among the many levels of any organization, as well as the need for continuous communication feedback loops about the project's progress may well stave off a knowledge vacuum. Revisions and adjustments can be made more easily this way.

Third, in doing so, it is important to note that the purpose of simplification is to address not only the structural arrangement but also the cognitive burden of pertinent actors (Gillingham, 2017). The case showed that premature revisions that confuse the standard processes, communication channels, and responsibility structure will eventually raise cognitive burdens and constitute a bad implementation. Worker frustration may in fact be frustration about not being well enough trained to manage the new systems; or feelings that they have not been included into the policy making and decision making processes; and then a fear of failure at managing the new information systems. Some employees may feel that the new system will make their work with consumers worse. In this context, employees' frustration plays a key role in the framework as a threshold or switch that flips the feedback loop to failure. Public managers need to manage the innovation process so that public employees' cognitive burden not exceed a threshold beyond which the vicious cycle of a knowledge vacuum begins.

Finally, there needs to be sincere and significant inclusion of stakeholders and the employees who have experience with the current systems, along with a lot of testing and pilot efforts to see how the innovation is being received. As listed above, the source of employee frustration is extremely diverse, and it is difficult to know what are most relevant without sincere communication between managers and employees. A participatory learning process such as TQM is usually accepted as facilitating learning (Swiss, 1992). Reform efforts that mitigate the likelihood of a knowledge vacuum would be inclusive and

respect the work of the existing staff while they assist in the design of reform.

5.3. Current state of the art

Finally, given the advance of ICT today, a potential question to be raised is whether there is any evidence that shows current e-government innovations in the public sector are no more subject to a knowledge vacuum. E-government innovations might have been in the ongoing stage to reap the benefit of the innovations (Jun & Weare, 2010), but maybe it's time optimism has its empirical ground. Although the empirical evidence noted above suggests performance improvement in several cases, there still seems to be a lack of sufficient evidence and agreement among scholars and practitioners with regard to the quality of management and performance of e-government innovations. The case study of Medicaid over 20 years is illustrative in that a knowledge vacuum could still occur regardless of technological advancement. More generally, the public sector has been adopting innovations such as cloud computing and e-voting system which are now known to be vulnerable in security issues, not just technologically but also physically and managerially. The conceptual framework suggests that it is not technological development or administrative reform that matters, but a broader organizational dynamic.

6. Conclusion

In this article, we suggested the conceptual framework of a knowledge vacuum to better understand e-government innovations and their failure by focusing on the learning dynamic of the innovations. We first summarized the historical unfolding and antecedents of e-government innovation to emphasize its heterogeneity. Then we provided the conceptual framework of a knowledge vacuum, and analyzed a case of e-government innovation failure. Finally, we discussed theoretical and practical implications of the concept along with its own limitations. Through the concept, we highlighted how the interaction between diverse structural and behavioral factors as either pushing or pulling forces of innovation result in a spiral toward a negative, rather than positive, organizational dynamic. The conceptual framework proposed in this article may be applied to explain past experiences and analyze upcoming e-government innovations. Furthermore, the conceptual framework may be relevant not just to e-government, but to other types of innovations that share similar characteristics as e-government innovations. The dynamic nature of a knowledge vacuum enables researchers to take variables such as interplays among structure and behavior, different organizational forces, and time into account under the comprehensive framework of organizational and policy learning.

Future research may take a few directions. First, the conceptual framework of a knowledge vacuum can be applied to diverse e-government innovation cases to confirm, revise, or expand the elements in the framework. Since the framework focuses on the interaction between structure and behavior, it would be especially beneficial to consider the role of organizational culture that links structure and behavior through comparative case analyses. Second, in light of the proposed practical implications, it would be both theoretically and practically helpful to investigate when the vicious cycle of a knowledge vacuum can switch from a negative to positive feedback loop by managerial endeavor. Finally, it would be useful to investigate what kind of technology and design can diminish the likelihood of a knowledge vacuum.

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- Taehyon Choi** is Associate Professor of Public Administration in the Graduate School of Public Administration at Seoul National University. His current research interests are organizational and social learning, e-government, and collaborative governance. His articles appear in journals such as *Journal of Public Administration Research and Theory*, *Public Administration Review*, and *Computational and Mathematical Organization Theory*.
- Susan Meyers Chandler** is Professor Emeritus at the University of Hawai'i. Previously she was full professor of Public Administration and the Director of the Public Policy Center. She served for 8 years as the Director of the Department of Human Services for the State of Hawai'i. Her research interests are in the fields of facilitating organizational change, collaboration, child welfare and program evaluation.