

**Assessing the Relationship between
Innovation and Survival in Organizations:
An Empirical Review, Research Synthesis,
and Analytical Case Study**

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ABSTRACT

This study provides a status report on innovation literature across sectors, with an emphasis on organizational survival. The literature is found to lack systematization of research studies or cumulative construction of knowledge about the relationship(s) between innovations and the survival or demise of organizations. In addition to research synthesis at various levels of analysis, spanning both academic and practitioner literatures, a research prospectus and set of prescriptions for cumulative and systematic development of key research themes is provided. Above all, researchers are urged to have their own studies and methodological applications speak to existing research, to questions raised and hypotheses proposed, with the aim of building empirical theory. In her review and prescriptive survey, author 1 advances four hypotheses connecting innovation with organizational mortality:

Hypothesis 1: Innovations do not affect the survival of their organizations

Hypothesis 2: Innovations increase organizational survival and sustainability

Hypothesis 3: Innovations increase organizational mortality short-term and long-term

Hypothesis 4: Innovations increase organizational mortality short-term but reduce it long-term

Accordingly, author 2 develops a historic case study, providing evidence for the fourth hypothesis, subject to confirmation. It is a study of a major information systems project failure in the United States that triggered both an organizational survival crisis and organizational resurgence. The focus is on the U.S. Bureau of Land Management (BLM) and its implementation with the Forest Service of the massive, extraordinarily expensive, and ill-fated Automated Land and Mineral Record System. While this initiative failed dramatically, scaled-back but strategic innovation rescued the agency, creating a successor project, the National Integrated Land System.

Introduction

Although considerable effort has been made to promote innovation and identify how to manage it, much less work has gone into considering the effects of innovations. This study considers the effects of innovations on their organizations and consolidates what is known now about these effects, then considers new methodological implications of this research synthesis, including the aptness of the case study method, movement among macro-, meso-, and micro-level analyses (i.e., inter-organizational, organizational/group, and individual levels of analysis), and prospects for resource-generation, structural-change, and other established theoretical streams. First, it examines the effects of innovations on their organizations by identifying a research framework, examines the relevant literature for normal and changed organizational

¹ The authors have contributed to the paper equally.

populations that might apply to each hypothesis, develops four possible hypotheses about the effect of innovations on the fate of their organizations, and explores how this might apply to innovating organizations. Second, the study examines a broader range of research questions about innovation that could be examined in the future. This empirical review concludes with a case study causally linking project termination and organizational crisis, and innovation and survival. It is an historic study of the U.S. Bureau of Land Management (BLM) Automated Land and Mineral Record System (ALMRS), from its genesis to its demise, and the birth of its successor National Integrated Land System (NILS).

The Effects of Innovations on their Organizations

Perhaps those who fear the effects of innovation on organizations are correct: it may threaten the organization—or it may help the organization survive. Without integrative research on the subject, no one will ever know with any certainty. Researchers studying these issues face numerous challenges—isolating the effects of innovations from those of other factors, identifying ways to identify the effects of innovations on their organizations, and ascertaining how to deal with the different levels of innovations, organizations, organizational communities and populations. These require different levels of analysis, from individual to group to organizational and inter-organizational levels, as to causal paths and impacts, with qualitative and quantitative research.

While organizations can be created or reorganized to facilitate changes in policies, processes and programs, at the same time, “Organizational change usually accompanies policy change” (Lewis, 2002: 102). Both innovations and their organizations must thus be considered. The following section of the study focuses on a research framework for studying and the effects of innovations on their organizations and leaves the separation of innovation from other factors influencing the fate of organizations for another time.

Approaches to Studying the Impact of Innovation: A Framework

In order to study the impacts of innovations on the fate of innovating organizations, researchers must decide which issues to study and on an approach. To take these decisions, they must make judgments about what might be important to innovating organizations’ fates.

Astley and Van de Ven (1983) developed a framework that considered micro (organization)/macro (population) levels of organizational analysis and deterministic/voluntaristic considerations of human nature to create a four-type framework for analysis of organization theories. Glor (2002) examined the innovations of a population, the Government of Saskatchewan, 1971-82 in deterministic and voluntaristic terms. Van de Ven and Poole (1995) found that the variety of concepts used to study how organizations changed have led to the compartmentalization of perspectives. They developed four basic (primitive) theories to explain processes of change in organizations: life cycle, teleology, dialectics and evolution and recommended considering how they interact.

Based on four philosophical paradigms (their term) developed by Burrell and Morgan (1979), Glor (2014) built four frameworks for studying the effects of innovation on

organizational survival. The research frameworks (Glor 2014 a, b) emphasize the impact of innovations on individual cases, employees, organizational functions, and the mortality of the organization, organizational communities, and organizational populations, by applying humanist, interpretive, functionalist and/or structuralist paradigms, respectively (Burrell and Morgan, 1979; Gioia and Pitre, 1990). The framework guides researchers, for example, to consider nine issues: each paradigm's definition(s) of innovation, the focus of study, the paradigm most suited to studying the issues of interest to the researcher, patterns being followed by innovators and their organizations, important distinctions that need to be made, the issues and levels of analysis suitable for study within each paradigm, suitable methodologies, measures and research questions that could be explored, and which types of impacts can be studied within each paradigm. The full framework is available in Glor (2014b). This allows a choice of approach and the selection of more than one approach appropriate to the questions being asked and the level of study, as recommended by Astley and Van de Ven (1983: e.g. 267). Depending on the focus of the research, timeframes being studied, definitions of innovation being employed, and features of organizations of interest, different frameworks are suitable for these studies and allow them to focus on different issues. The frameworks are distinguished in several ways, including the different definitions of innovation used, which are often implicitly rather than explicitly stated: Case studies typically define innovation as something new to the organization adopting it, a focus on personnel (managers and working level people) defines innovation as new at any level, a focus on functions defines innovation as new to the organization, and a focus on impacts on the population (such as a demographic approach) defines innovation as new to the population (government) and/or organizational community (Glor, 2014: Table 1). Organizational communities often cross sectors and are typically local heterogeneous internal and external networks, consultations, collaborations and other organizational community activities and supports for innovations. An organization relates to a community, e.g. all Canadian provincial governments. In biological evolution, populations are species and only populations evolve because evolution is structural. Organizational populations are restricted to one sector, are unique, and relate to a substantial geographic area, for example, a government. The use of the term "innovation" in different ways could confuse it with change, reform and adaptation. Change only implies something has been made or has become different. Reform adds to change the element of improvement. Innovation always implies newness in the context in which it is being introduced (Rogers, 1995; Glor, 1997). Glor (1997, 2002) limits innovation to the first, second and third time an innovation is introduced in a government (a population); it thus presents many additional challenges beyond those presented by change, reform and adaptation. Each of Glor's frameworks has benefits and disadvantages and faces different challenges securing access to the information required to conduct the analysis within the framework chosen.

Glor's frameworks emphasize the need to study the effects of innovation on organizations in numerous ways and suggests that different theoretical concepts, methodologies and measures are needed to study different aspects of innovation effects. Effects of individual innovations are best studied ethnographically in case studies, using grounded theory and other qualitative methods; effects on personnel using testing, surveys and data from personnel systems; effects on factors using functional and/or ecological approaches and measures for resources, the internal and external environment, and using survival analysis; and effects on innovating organizations and their populations using a structural approach. The effects or impacts of innovation depend as

well on the support for the innovation and how well it is introduced. Innovations that fail have different impacts than ones that succeed (Glor, 2015; Rivera & Valdez, 2007).

Once the dynamics are understood, the fate of *organizations* and their *populations* is best studied using demographic measures. These could include for example, for innovations, individual organizational innovation adoption rankings; for organizations, date of founding, length of survival, mortality² rates, and hazard rates; for organizational populations, population adoption rankings, and for organizational communities, innovation and organizational founding and mortality rates (Glor, 2015). Glor (2014) suggested detailed examinations of the effects of innovation on individual and comparative cases, personnel, the functions of the organization, and the organization's structure, fate, community and population. To address these issues requires in-depth analysis of case studies but at the same time a more general answer requires research on many cases and organizational communities and populations.

The fate of organizations that innovate is framed in four hypotheses below. Using the existing literature, information supporting and detracting from each hypothesis is identified and the possible implications for innovations and their organizations are discussed.

Literature and Four Hypotheses about the Fate of Organizations that Innovate

While there is a considerable amount of research on the fate of organizations, there is little research on the fate of innovations or the fate of innovating organizations. Four very different hypotheses can be proposed about the effects of innovations on their organizations. Each of them has at least some support but the literature is somewhat contradictory. Literature and the hypotheses they support are examined. Based on the published literature, the following arguments can be made and hypotheses can be derived from the evidence.

No relationship between innovations and the survival of their organizations

This is where we stand now, because we do not have sufficient evidence to claim otherwise. The public choice literature, in particular, argues that the public sector should do less, not more; that improved performance is primarily about reducing costs rather than about improved services/programs, and so innovation is only of interest if it saves money (part of "functions" in Glor's framework). It also asserts the public service is not inherently innovative, and it must be held in check through rules and regulations (summarized by Kelman, 2008).

Borins (2001: 9) found that eight of 95, 8.4 per cent of the winners of the Ford-KSG awards from 1986-95 disappeared by 1996, a twelve year period (assuming the innovation existed for at least one year prior to being nominated) and a 0.7 per cent per year mean mortality rate. Farah and Spink studied the mortality of 140 local government innovation award nominations in Brazil from the first seven years of the award program. Of the sixteen that had

² Mortality is the disappearance of an innovation or organization or population from the record. This can occur due to succession (a program or organization being integrated into another, perhaps with different objectives; reorganization, transfer to another department, etc.) or termination (complete disappearance). An organization is a formally organized entity employing people.

been discontinued, eleven per cent mortality, four had changed location from the public to the nongovernmental sector and seven had been discontinued for political reasons. Half had been taken up elsewhere. Political reasons, such as a change in party, were not overall a significant factor (2008:13). It should be remembered, however, that innovation award nominees and their organizations are not normal organizations (Hartley, 2008). Although some authors have argued that award nominees are representative of populations of innovations in terms of novelty, sustainability and comparability (e.g. Borins, 2001), we do not agree. Compared to a normal population of innovations, innovation award nominees usually have more support from personnel, management and elected officials than normal innovation populations, they are solely a sample of successful innovations, and they were assessed for survival during a relatively short period of time. They are probably not, therefore, a good source of information on the survival of innovation. Moreover, little information is available: innovation award applications do not typically report the survival period of their organizations. This debate can only be resolved through innovation population research over the long term.

The following hypothesis can therefore be derived:

Hypothesis 1: Innovations do not affect the survival of their organizations.

Innovations affect organizational survival and sustainability positively

If innovations help their organizations survive, what could explain this phenomenon? One argument is that innovations help organizations adapt and organizations that adapt to current conditions successfully are more likely to survive. Some authors suggest the innovations then become reified and obsolete and have higher mortality rates than other organizations (Hannan & Freeman, 1984; Le Mens, Hannan & Polos, 2015a, b); others do not (Sorensen & Stuart, 2000). To avoid obsolescence, organizations would presumably need to keep innovating, as conditions change, in order to survive: some authors found that once organizations changed they were more likely to change again (Amburgey, Kelly & Barnett, 1993) and to disappear. Whether organizations that innovate then keep innovating is worth exploring. From a different perspective, Greve and Taylor (2000) found innovation can act as a catalyst for organizational change. Studying radio format changes, they discovered that innovations had an effect on the rate of nonmimetic (non-imitative) change: innovations by large organizations had less of a catalytic effect, innovations in nearby or large markets had greater catalytic effect.

A second argument suggests that fully established and accepted innovations (legitimate ones) are not popular targets for budget or program cuts in any sector (private, non-profit, public). Canada's neo-liberal Conservative party, for example, announced during the federal election of 2015 that if reelected they would reintroduce a program similar to Canada's earlier universal family allowance program, abolished by a progressive conservative government during the late 1980s. The Liberal party elected then introduced a new program for the same group. This would seem to suggest that government programs may not become obsolescent in the same way that private sector ones do (see Hypothesis 3) and always have supporters.

The following hypothesis can be derived from this evidence:

Hypothesis 2: Innovations increase organizational survival and sustainability

Innovations negatively influence organizational survival short- and long-term

Numerous factors contributing to increases in organizational mortality rates have been studied. Because innovation creates change, for hypotheses 3 and 4, the liability of youngness/ adolescence, demonstrated with change in organizations, could be an important factor. Changes probably increase mortality rates, at least in the short term (discussed in detail under Hypothesis 4). Here what correlates with increased organizational mortality is reviewed.

Private and Non-Profit Sectors

A number of liabilities affecting organizational survival have been identified. Examining already-existing organizations on the list of the Fortune 500 in the U.S., Hannan and Freeman (1977) identified a ***liability of smallness*** (1977: 959). They studied the organizations in 1955 and again in 1975, reporting that 78 per cent of small businesses but only 25 per cent of large businesses died over the 20 year period. Since small organizations died at triple the rate of large ones, smallness was considered a significant liability.

By studying almost all of a population of government registrations and mortalities of private sector organizations in one area of Germany, Brüderl & Schüssler (1990) demonstrated a liability of adolescence (discussed in the next section) and a ***liability of lack of resources***. They calculated the mortality hazard of 155,415 business registrations and de-registrations for Munich and Upper Bavaria, in then-West Germany between January 1, 1980 and March 31, 1989. The database included industry, trade, and service business foundings, but excluded crafts, agribusinesses, physicians, architects, lawyers, and the few firms with more than 99 employees. Like Hannan and Freeman, they found a ***liability of smallness*** (size). A liability of smallness and resources is a higher risk of mortality for small and poorly resourced organizations compared to large and well-resourced ones. Rather than the previously-used Makeham model (Hannan & Freeman, 1977), Brüderl and Schüssler used a log-logistic model to study businesses during the 9.25 year period and observed an overall 65 per cent mortality rate during that period (personal correspondence with Dr. Brüderl, January 6, 2009). In their meta-analysis of studies of innovation and organizational size, Camison-Zornoza et al (2004: 350) confirmed a significant and positive correlation between ***size*** and innovation.

Drees and Heugens (2013) conducted a meta-analysis on 157 resource dependence studies and confirmed Pfeffer and Salancik's (1978) theories. Using resource dependence theory (a framework for understanding organization-environment relations), they found that organizations respond to resource dependency by forming ***inter-organizational arrangements*** like alliances, joint ventures, in-sourcing arrangements, interlocks, and mergers and acquisitions. These make them more legitimate and autonomous. The mechanisms linking arrangements to organizational legitimacy and autonomy differ across arrangements. They also addressed whether resource dependence theory is a theory of organizational performance, finding that autonomy positively mediates between arrangement formation and performance but legitimacy does not. They suggested that resource dependence theory can explain organizational actions that have societal acceptance as opposed to economic performance as a motive (Drees & Heugen, 2013: 1666).

Baum, Korn and Kotha (1995) found an important difference in the mortality of facsimile (fax) companies prior to and following a change in the ***dominant design technology*** favoured by customers. Amburgey, Kelly, and Barnett (1993), studying all 1011 Finnish newspapers ever

published between 1771 and 1963 from birth to death, examined not only whether organizations survived, but also the impact of change on them. Rather than considering organizational demographics and resources, as other researchers had done, they reviewed factors under management control; namely, newspaper content and frequency of publication. **A change in content** of publication was, for example, a shift from general to specialized content, which was seen as a goal change. Specialized content included newspapers focussing on such issues as political content (most) and non-political issues (a minority), like economic news or religious topics. Frequency of publication was usually either weekly or daily.

Garlock (1974) studied American and some international local assemblies of the Knights of Labor, 1869-1896. He identified **political variables** as important to survival: They were capital city location and organized third-party electoral involvement. Locals were either in a capital city or not. Capital city location correlated with a lower death rate in the first year. This created a **non-capital city liability**. Carroll and Huo (1988: 188) speculated that employers might have refrained from or been restrained from taking strong measures that they might have taken if located in capital cities. Locals either ran as a political party in local elections or did not. In areas where there was a labor party in the county, the locals were less likely to die. This created a **non-political liability**. The greater survival rates could have been due to a spillover effect from strong local assemblies organizing labor parties; alternately, the effect could have been due to protection provided by the labor party in power. Spillover would likely lead to few additional benefits for the local, while protection would probably lead to further benefits.

The political success of locals correlated with the loss of viability of both the national organization and the local assemblies. In areas where labor parties were unsuccessful electorally, locals had greater longevity. This was an **electoral success liability**. Carroll and Huo (1988: 191-192) suggested this paradox is due to the utopian nature of the Knights and the labor parties—once elected, the legitimacy of party and locals was quickly undermined. The authors also observed that the victorious political parties almost created their own local political environments, a potentially relevant factor for public sector (government) organizations. Carroll and Huo did not find economic factors to be important.

In their study of 389 voluntary social service organizations (VSSOs) in Toronto, Canada that changed from 1970 to 1982, Singh, House, and Tucker, using a time-varying covariate model, identified six core changes: goal, structure, service area, sponsor, chief executive officer, and location (1986: 598).³ Two hundred and seventy VSSOs experienced **structural changes** (undefined) but few changes in service-area (presumably type of service/activities), goals or sponsors. Twenty-eight per cent of the 389 organizations died during the 11-year period.

Resources (as defined by Aldrich & Staber, 1988, Table 2) were also critical for the VSSO non-profit organizations. **External legitimacy** and the **support of major institutional actors** were important to the survival of young VSSOs (Singh, Tucker & House, 1986). Isomorphism (imitation of form) was seen as contributing **legitimacy** to the organizations (Singh, House & Tucker, 1986). Legitimacy requires recognition from actors outside the organization, in the environment.

³ Birth was formal incorporation, death was ceasing to exist as a formal entity. Mergers were counted as deaths: only five mergers occurred.

Some authors argue there is a *liability of obsolescence*, meaning that organizational mortality rates increase as organizations age. This is argued in particular by Le Mens, Hannan and Polos (2011; 2015a, b) who, continuing to develop Hannan and Freeman's (1984) argument for structural inertia, reason that organizations become steadily more obsolescent (measured by number of patents secured) as they age. The authors demonstrated this effect up to age 10 in the microbrewery and brewpub industries (using Swaminathan & Carroll's [2000] database), but the effect flattened out between ten and twenty years of age, the end of the study. Le Mens, Hannan and Polos (2015a: 563) described a liability of adolescence (occurring before age 10 years), followed by a liability of obsolescence (a flat mortality rate). In a limited number of industries, such as the microbrewery and brewpub industries, and possibly the information technology (IT) industry, a ten-year old organization might be classifiable as aging and becoming obsolescent, but these are fairly unique industries—they are unstable and obsolescence-prone. The results cannot be generalized to other organizational populations and so it does not adequately demonstrate that older organizations have a higher mortality rate. The pattern they describe was observed and defined as adolescence in population studies. Glor's (2013) synthesis of 21 organizational mortality population studies considered young was up to 15 years old, middle age was 16 to 30 years and old was over 30 years. Organizational demographers found lower mortality rates as organizations got older (see hypothesis 4) but did not examine old organizations separately.⁴

Le Mens, Hannan and Polos' second argument is an assumption—that people (employees) systematically prefer the status quo (2015b: 1, 3) and resist change (2015b: 5). This could suggest that if existing employees are made responsible for innovations, they may not be very enthusiastic about the innovation, will introduce as little change as they possible, and other employees will resist the change implied. This idea of employee resistance to change or perhaps “newness” has not been explored a great deal. The thesis would seem to suggest, however, that little or no innovation or change should succeed in the short or medium term (until people accommodate to it) and this is not the case (e.g. Glor [1997, 2002] found all but a few of the 160 innovations of the government of Saskatchewan were successfully implemented).

While personnel may sometimes be reluctant to introduce changes they believe the changes could harm them or their programs, we are not aware of evidence that they resist all change or innovation. In our experience, personnel are usually quite interested in innovations and do not resist them without reasons pertinent to the success of the program, process or organization, not because of personal reasons. While it is possible they are deluding themselves, and are really motivated by self-interest, the evidence to demonstrate Le Mens, Hannan and Polos' assumption is not available. Carpenter (2000) and Lewis (2002) found older US federal government organizations had lower mortality rates.

Public Sector

As described above, a number of survival risks (liabilities) have been identified in private and non-profit organizations and some presumed risks have been denied. Public sector organizational populations have also been studied. In addition to the private and non-profit

⁴ Le Mens, Hannan and Polos (2015 a: 562) argued other studies should have controlled for age-varying size.

populations reviewed above, Glor (2013) found fourteen public sector organization mortality studies, half of them of the American federal government but rejected some because of biases.

American federal government. Several substantial studies considered public sector organizational survival at the U.S. federal level, using the USGM, the official handbook of the American federal government (USGM, 2013: Table 4, 3). It provides information on organizations of the legislative, judicial, and executive branches, and includes terminations and transfers of agencies. Senator Roth discovered, as did other researchers, that there is no single listing of government programs, and so it is difficult, he said impossible, to identify them (Daniels, 1997: xiii-xiv). The USGM is therefore a highly valuable, albeit macro level, resource for those interested in public sector organizational mortality.

Early work started on a political note by defining organizational mortality as “termination,” thus emphasizing the role of human will in organizational mortality, and claimed public sector organizations were practically immortal. The idea of agency immortality was introduced by Downs (1967) and Lowi (1979). Herbert Kaufman’s *Are Government Organizations Immortal?* (1976) had a major impact in defining the character of the study of public sector organization mortality. It was somewhat contradictory, both cautioning against reading too much into work and asserting that more public sector organizations needed to be terminated.

Kaufman (1976: 34) examined the number of public sector organizations that existed at the U.S. federal level in executive agencies in 1923 and then again in 1973. In 1923 this included seven executive departments, to which by 1973 four new departments were added—Housing and Urban Development; Transportation; Health, Education and Welfare; and the Executive Office of the President). Many of the 175 agencies existing in 1923 had existed since the first federal government took office in 1789. Although *Are Government Organizations Immortal?* has many caveats about the conclusions that can be drawn from the study, conclusions were drawn, including a suggestion that the growth of federal government organizations was on a trend that would lead to far too many public sector organizations (undefined). Kaufman made a strong argument for the risk presented if public sector organizations were immortal, concluding that they largely were. He based his argument on simple math—in 1923 there were 175 organizations in the executive department database, of which 148 still existed in 1973, including 31 at lower administrative levels and 8 no longer in executive departments (1976: 34). He described the increase as “explosive growth” in the number of organizations in the government and asserted that attendant problems were approaching rapidly and may already have arrived (1976: 70).

There were problems with this research, however, as detailed in Glor (2013). For example, the research was not representative of the U.S. federal government (only studying executive agencies and omitting the Department of Defense), selected organizations to study from non-comparable periods, studied only two points, omitted completely organizations created and also disappearing during the 50 year period (for example, all of the Depression-era, World War II, Korean War, Viet Nam War, and Just Society public sector organizations that were created and then abolished), many of the initial organizations existing in 1923 were already old and were even older in 1973 (old organizations have low mortality rates), and the data used had left, middle and right censoring (data missing).

Kaufman argued that these old organizations were more likely than new organizations to die, but the private and non-profit literature found the opposite. Kaufman admitted that he had made every effort to show that government had grown and not shrunk, and indeed he did—his study had major biases in favor of the growth of government, and ignored most of the mortalities. He did not, therefore, convincingly demonstrate that PSO growth was explosive nor provide examples of explosive growth. Kaufman indicated that the rate of growth he found in the limited group of organizations he examined only matched that of the growth of the population of the United States of America as a whole. This would not seem to suggest a problem, let alone a major problem. Despite admitted biases built into Kaufman's study, conclusions were drawn: Kaufman's research became canon in the public sector termination literature. Several subsequent authors based their arguments on Kaufman's argument (e.g. Brewer & de Leon, 1983: 390; Daniels, 1977). Much writing on it quotes him, and quotes him erroneously as having shown that public sector organizations are immortal (e.g. Brewer & de Leon 1983: 390). The presentation of organizational death as a political, organizational and public policy objective and its promotion occurred only in the public sector and its literature, not in the private or non-profit literature. Little or no accompanying research has addressed the effects of reductions in resources on public sector organizational survival, although resources were demonstrated to be an important control factor for organizational survival in the private and non-profit literature.

Better quantitative studies of public sector organizational survival and termination in the US federal government were conducted following Kaufman's study (Peters & Hogwood, 1988; Lewis, 2002; Carpenter, 2000), and errors in the initial research were corrected. These researchers did not find that US federal organizations were immortal. Lewis demonstrated that the overall mortality rate for federal government agencies over the thirty year period 1946 to 1997 was, rather than immortality, a 62 per cent death rate over 31 years. Instead of a lower rate, this mortality rate for public sector organizations is similar to and often higher than the long-term death rates reported in either the private or the non-profit sectors. Lewis argued it is a myth that government organizations have a low mortality rate. Including all organizations founded and abolished during the entire period, Peters and Hogwood (1988) examined births and deaths in the US federal bureaucracy from 1933 to 1982 and found active births *and* deaths. Working from Kaufman's (1976) data set, and using a non-linear model, Daniel Carpenter firmly rejected the claim from the public choice literature that the hazard rate of agencies is monotonically decreasing (Carpenter, 2000).

Kaufman's research assumed that *older organizations* were more likely to die. In the private and non-profit sectors, large, older and well-resourced organizations were less likely to die. These phenomena were also demonstrated in the public sector by Carpenter (2000) and Lewis (2002). Carpenter examined these issues by calculating the product limit estimates for the hazard rate of all executive departments established from 1865 to 1923 (2000: 91). He demonstrated that old organizations were not more likely to be terminated, and that the hazard rate is nonmonotonic (not consistent) and nonzero. Lewis (2002) built on this work by (1) analyzing data that were not biased toward durability (i.e. by studying all organizations and young as well as old), (2) including agencies that did not exist in 1923, and (3) estimating models including covariates to examine substantive causes of mortality. He studied new organizations reported in the USGM created after 1946 and still in existence in 1997, so some organizations existed for short periods of time, others for fifty years. Lewis reported an overall

mortality rate of 62 per cent during the 50 year period, compared to Kaufman's 27 per cent mortality rate studying two points in the previous 50 year period.

Other governments. Organizational mortality and sometimes control factors have also been studied in other countries. In the Westminster system countries of Ireland and Canada, governments consist of large umbrella departments with numerous organizations below the departmental level. Ireland has a legal limit on the number of departments and Canada has consistently restricted the number of departments (Glor, 2013), as has the US. Irish studies found a mean yearly mortality rate between 0.78 and 1.1 per cent. The Canadian studies ranged from 0.51 to 0.60 per cent per year. The study of the earlier British colony of the Canadas found a high mortality rate because it was created and abolished within 20 years (Hodgetts, 1956; Glor, 2011). Because the government and all departments were abolished, its censoring was different from that of the other studies. Both Ireland and Canada created a substantial number of agencies (typically more independent than departments) starting in the late 1980s. The mortality rate in the Norwegian government was 1.15 per cent from 1947-2010 and in the West German and then German government it was a mean of 0.28 per cent per year from 1949 to 2006. The mortality rate among two kinds of mostly large (therefore a biased population) Korean quangos⁵ from 1993-2010 was 2 per cent per year. Glor (2013) found the mean mortality rate in 21 normal organizations were all under 1.03 per cent per year.

Public Sector Factors

Public sector factors have been examined by numerous authors through correlates (Glor's functional approach) of survival and mortality, with a view to understanding causal effects. Lewis emphasized both the politics of agency termination *and* controls and constants. Firstly, he addressed **political factors** several ways: two are discussed here. First, he measured **unified government**, the degree of political change since the last government, on the assumption that an agency created under a government where the president and Congress were of the same party would be at most risk under a new government of a different party and a unified president and Congress. The unity of the Congress and the president were measured by an unfriendly (different political party) majority in the Congress, an unfriendly president, an unfriendly Congress and president, and interaction between them. In about 46 per cent of the observations, different parties controlled the presidency and the houses of Congress. This measure is based on party differences, but there are disagreements in the literature about how important parties are. Lewis therefore developed a second political measure, a set of models based on non-partisan **policy preference** measures. He employed measures for the House and the presidency, and compared the legislative and executive branches (Poole, 1999). Lewis measured degree of ideological change from the time the organization was created until the observation, with the expectation that a large degree of ideological change between these actors and overall would create a greater risk to the agency. A low ideological difference was expected to represent a low hazard (Lewis, 2002: 93-95).

Political turnover was also an important factor: **unfriendly presidents** increased the hazard rate by 0.67 and **unified governments** by twice. The most dramatic change in probabilities

⁵ In countries such as the Republic of Ireland and UK, quangos are quasi-autonomous non-governmental organizations to which the government has devolved powers.

occurred with the most dramatic type of political turnover, a change from a unified government (president and Congress of the same party) to a unified government of the other party. In the Canadian government this is only a shift from a majority of one party to a majority of a different party, a regular occurrence, though one which frequently had minority governments between them. Measures based on *policy preferences* rather than partisanship confirmed the findings for the *preferences of the president* and a *preference change in both branches of government*.

Secondly, Lewis examined controls and constants for other hazards (variables-controls), including the economy, war, competition among agencies, a new presidential administration, and characteristics of the agencies (Lewis, 2002: 95). The *economy* was measured through average yearly unemployment, on the assumption that political actors cut spending during economic hard times, and that one of the ways to reduce spending has been through agency termination and reorganization. *War* was measured by identifying whether the U.S. was at war, because Congress has historically given Presidents discretion to reorganize the government during war efforts. *Competition among agencies* was measured by the net number of new administrative agencies created during a year. A *new presidential administration* was thought to represent a hazard for organizations because of presidential attempts to improve management capabilities, to gain control of the bureaucracy through reorganization, and generally to restructure government.

Agency characteristics that represented hazards were an *agency designed to be temporary* (one of the strategies of those who sought more terminations), agency *origin in executive decree* (rather than legislation), and *small size*. Lewis hypothesized that agencies created by statute and large agencies, with a line in the budget (and therefore with many employees or affecting many people) were more difficult to terminate than small agencies with small budgets, employing few people and agencies targeted at specific interests are easier to terminate (Lewis, 2002: 96). Although agency durability has been modeled by others through the natural log of the survival time and the hazard rate, Lewis modeled it through the hazard rate. Because four parametric hazard models were inconclusive, Lewis used a Cox proportional hazards model, where a one unit shift in an independent variable increases the hazard rate and decreases agency durability (2002: 97). Since the data set had multiple observations on each agency, he used an estimator of variance that adjusted correlation of errors on data on the same agency (2002: 97).

Lewis found the hazard rate for agencies was much higher during *wartime*, a new presidential administration (positive but not significant at the 0.05 level), and for agencies *created by executive action*. Competition among agencies was not important—the number of federal agencies (density) did not increase agency hazards; rather, *during growth the hazards were lower*. Lewis reasoned this was because tax revenues were growing, and an increase in the number of agencies did not mean increasing competition for scarce budget resources (which he did not measure).

Lewis concluded that government organization mortality has been high, not low as popular myth would have it and that agencies were at greatest risk when the *degree of political turnover* was greatest. Turnover from unified control by one party to unified control by the other increased agency hazard rate by more than 260 per cent. Lewis raised a possible limitation in his findings, including the possibility that agencies created since 1946 have been less durable than those

created prior to 1946. Although agencies created prior to 1933 were more likely to be created by legislation, Lewis found no reason to conclude there were other differences among the periods. Abolishing government departments has not been a politically neutral activity. **Republicans** were *more likely* to cut government programs than Democrats. The introduction of sun setting programs, i.e. programs with temporary (often four or five year) mandates, introduced in 1976 (Daniels, 1997: 36), has made it easier to terminate programs.

Mortality rates and organizational age. Organizational mortality rates may have gone up during the neo-liberal era (since the late 1970s/early 1980s), perhaps in part because of its intent to abolish public sector organizations and/or because of its destabilized economic environment, but this has not yet been demonstrated, in part because of reduced funding for research. Lewis (2002) confirmed that public sector organizations are not immortal by studying the fate of the 426 agencies created in the U. S. government from 1946 to 1997. Sixty percent of newly created organizations were abolished during that period.

Using different tools, Carpenter and Lewis (2004) reanalyzed Lewis' (2002) data on American agencies (not executive departments). From 1946 to 1997 (50 years), 398 new agencies were created, of which 227 were terminated, a 57 per cent mortality rate. They constructed numerous models, including log-logistic, generalized gamma, and Cox models. These models tend to overestimate agency hazards early and underestimate them later. They also constructed an ordinary logit model. Because they discovered two equal hazard peaks, at ages 2 and 5, followed by a fairly steady decline in mortality, they rejected the hypothesis that public sector organizational mortality declines monotonically (Carpenter & Lewis, 2004: 218-22), concluding that **organizational mortality declines non-monotonically**.

Peters and Hogwood (1988) repeated Kaufman's study but considered the entire federal bureaucracy (executive departments and agencies) from 1933-82, a much bigger database of 2245 organizations. Like Kaufman, they restricted the definition of mortality to total termination but used a different methodology. Glosser and Jochim (2009) reanalyzed Lewis' (2002) data (years 1946-97), using an event history analysis. Peters and Hogwood (1988), Glosser and Jochim (2009), and Lewis (2002) argued it is a myth that American public sector organizations have low mortality rates—to the contrary, mortality rates in the American government have been high, rather than very low, compared to the private and non-profit sectors (Glor, 2013).

Lewis (2002) saw the **implications of agency mortality** as threefold. First, even if agency functions continue, organizational structure determines the degree of influence of political actors. In the American federal political system, the president appoints managers four levels down in an agency. Even if the functions continue, abolishing the structure and integrating the functions into another structure potentially **reduces presidential influence** on the functions. Lewis suggested that **public policy outputs and organizational structure** are inextricably **linked** (Lewis, 2002: 102). Second, **if agencies are terminated frequently**, agency structure does not protect agencies from political influence, as previously thought. Third, the politics of delegation, agency creation and design continue after agencies are formed, and the **coalitions** formed to create them continue to promote them, seek higher budgets, and protect them over time. He recommended research on whether certain types of agencies, especially those insulated from political control, are indeed more durable.

Innovating Organizations

Innovating organizations ***could be*** subject to the same factors as other organizations that change. A liability of change presents a particular challenge to the pro-change and pro-innovation literature, because it is contrary to what proponents have implied—that innovation is good for organizations. The private sector literature found that there are liabilities associated with the organizational traits of adolescent (and young) age, small size, and lack of resources, and that adolescent, small organizations with limited resources are considerably less likely to survive than large, old, well-resourced organizations. It also found that organizational change, which in evolutionary approaches is considered the attempt to adapt, increases rates of organizational mortality, and increases them considerably, to equal the mortality rates of young organizations. Innovating organizations may be subject to these same liabilities.

These factors could be having their effect for several reasons. First, the innovations that were not very successful and their organizations may already have disappeared when young: the small, poorly resourced innovations and organizations may be gone from the population, and the popular, well-funded, large ones may remain. Second, there may no longer be much room for new organizations in the organizational niche (Hannan & Freeman, 1988; Ranger-Moore, Banaszak-Holl & Hannan, 1991) and so fewer new organizations may be in the process of being created. As a result, distinguishing whether organizations have survived because they were innovative from other factors such as age and niche can be challenging. Third, an argument can be made that, in populations that have existed for a long time (e.g. newspapers), older organizations are contributing more to the mean survival than younger organizations. If younger organizations were contributing a great deal to the mean, it could be because many new organizations were being created, because there was room for them in the niche, or because they were not surviving in large numbers and others were replacing them.

A fourth argument supports the hypothesis that once the innovation and its organization become old, organizational mortality will increase: This version of the argument links innovations and innovating organizations in the public sector to politics and especially ideology (which changes infrequently) (de Leon, 1983; Lewis, 2002; Glor and Ewart, 2017). During the post-World War I era, government expanded, liberal governments added programs for returning soldiers and the population-at-large. Conservative governments tended to leave most of the innovations of liberal governments in place. Since the beginning of the conservative era in 1979, when many more and more right-wing conservative governments have been elected, they have tended to dismantle programs of the liberal era (e.g. progressive taxation) and when liberal governments have been elected, they have tended to leave in place changes made by conservative governments. The aging and mortality of innovations and their organizations have been caught up in this ideological transition. Hence, old innovations and organizations may have some increased tendency toward mortality not because they are old but because they do not fit well with the current dominant ideology.

Garlock (1974) suggested a different version of this argument He found ***reorganized*** locals of the Knights of Labor had higher mortality rates than initially established (pioneer) locals but only in two later age groups. He identified reorganization status as the number of times

the local assembly had been reorganized. This is a ***liability of change (reorganization) in older organizations***. Carroll and Huo (1988) postulated that areas where local assemblies were re-established were areas hostile to the Knights, while in more receptive areas the assemblies thrived and did not need to be reorganized. These two studies indicate that the ‘organizational mortality’ construct may be applied to the fate of branches or divisions of agencies or firms (in whatever sectoral or cross-sectoral situation) without denoting death for the entire organization.

There is a limited amount of research supporting the argument that innovating organizations are more likely to disappear. It includes the following:

1. A follow-up on innovations nominated for the European Quality Awards in 2006: Pollitt, Bouckaert and Loeffler (2006) found 45 of 65 could not be located at the same phone number after two years.
2. A study of nine Canadian innovations functioning in eight innovation patterns (Glor, 2015) found four of the nine innovations’ organizations disappeared: Literacy New Brunswick (the organization, not literacy training) within two years, Agriculture Canada’s public-private partnership database privatized to a non-profit organization within three years, Potash Corporation of Saskatchewan privatized within 14 years and the City of Mississauga’s separate continuous quality improvement program within five years, shortly after receiving its own organization.

High short-term mortality rates among innovating organizations could potentially be explained by their newness (young or adolescent), which has been demonstrated in the literature to enhance mortality until organizations reach middle age (see below). Baum, Korn and Kotha (1995) found, importantly, that there is a liability associated with all kinds of change, a ***liability of change***. It is an increased likelihood of death among organizations that change. This could also be true for innovations. Amburgey, Kelly and Barnett (1993) found support for the following hypotheses: (1) Organizational change increases the failure rate of organizations, independent of the effects of the changed characteristics; (2) The disruptive effect of organizational change increases with the age of the organization; (3) The disruptive effect of organizational change decreases with the elapsed time since the occurrence of the change; (4) The probability of an organizational change increases with the number of prior changes of the same type; (5) The probability of a given type of organizational change decreases with the elapsed time since the last change of the same type; (6) The probability of organizational change decreases with the age of the organization; (7) Early occurrence of a change of a given type increases the probability of subsequent changes of the same type. Factors have been studied substantially in normal organizations, finding increased mortality in young organizations but not in older organizations.

The following hypothesis can therefore be derived:

Hypothesis 3: Innovations increase organizational mortality rates short-term and long-term

Innovations increase organizational mortality short-term, reduce it long-term

This hypothesis is supported by different arguments—the weakness of the support for the previous three hypotheses and the weighty evidence available provided by the well-documented and substantial organizational demography literature. It found increased mortality among young

and adolescent organizations (e.g. Brüderl & Schüssler, 1990) and some changed organizations (Freeman, Carroll & Hannan, 1983; Singh, House & Tucker, 1986; Carroll & Huo, 1988; Brüderl & Schüssler, 1990; Amburgey, Kelly & Barnett, 1993; Glor, 2013).

A well-explored argument suggests that young organizations have higher mortality rates and old organizations have lower mortality rates: "the older a bureau is, the less likely it is to die" (Downs, 1967; Glor, 2013). In the *private sector*, researchers initially thought that differences in organizational survival rates were related to a **liability of newness** (Stinchcombe, 1965) or increased likelihood of organizational mortality associated with being a new organization. Aldrich, Marsden and Marsden (1988), Hannan & Freeman (1988) and Singh and Lumsden (1990) found this liability as well. Freeman, Carroll and Hannan (1983) reported on three groups of organizations: semiconductor companies, newspaper publishing organizations, and national labor unions (many labor unions were in the non-profit sector). Although the mortality rates of young organizations and overall survival rates were different among different types of organizations, the mortality rates of young organizations were consistently about five times higher than those of old organizations (Freeman, Carroll & Hannan, 1983: 702). These were large liabilities of newness.

This literature did not identify the shape, only the magnitude of the impact of newness on organizational survival, but Brüderl and Schüssler (1990) suggested that this theory required that its shape should be expected to be a steady decline in the rate of mortality from founding to mortality. As discussed below, Brüderl and Schüssler found that it was not. The highest mortality rate was not during infancy, as expected, but at adolescence among private sector organizations. When Carroll and Huo (1988) examined the Knights of Labor, in the non-profit sector, they also found the shape of the decline of mortality was not monotonic (steadily downward). While young organizations died more frequently than old ones, the highest mortality rate was at a slightly later age, called adolescence. Other studies also found mortality rates were highest during adolescence, but adolescence did not occur at the same age in all organizations (Carroll & Huo, 1988).

By studying almost all of a population of government registrations and mortalities of businesses in one area of Germany, Brüderl and Schüssler (1990) demonstrated a **liability of adolescence**. They demonstrated that neither the continuous decline to be expected from a liability of newness (Stinchcombe, 1965) nor the continuous decline of mortality rates expected in a population ecology approach (Hannon & Freeman, 1984: 157) existed in their population. Instead, they concluded that there is both a liability of adolescence, which they sometimes called post-adolescence (an age-related control factor), and other liabilities (see previous hypothesis). A liability of adolescence is a higher risk of mortality for adolescent organizations compared to young and older ones. The age-related mortality pattern was fairly low mortality in young organizations, increasing to adolescence, and then declining mortality.

In the non-profit sector, a curvilinear, nonmonotonic (with variation) pattern of organizational mortality has been reported in three studies, of business interest associations (Aldrich & Staber, 1988), voluntary social service organizations (VSSOs) (Singh, House & Tucker, 1986; Singh, Tucker & House, 1986) and the Knights of Labor (Carroll & Huo, 1988). (We are not aware of such an analysis for other studies). In their study of 11,851 locals of the

Knights of Labor, Carroll and Huo (1988) found four environmental selection mechanisms at work, of two kinds, organizational and political. The *organizational variables* were niche width and reorganization. *Niche width* was either specialist (all local assemblies organized on a single trade basis) or generalist (all others), a distinction known as fitness set theory (Levins, 1966; Hannan & Freeman, 1977). While specialist local assemblies were particularly vulnerable to hostile forces, Carroll and Huo argued that they were likely to generate high internal solidarity. Compared to generalist locals, they found a syncopating pattern of effects for the specialist organizations, involving a higher initial mortality rate in the first year, then lower rates in the next two years, followed by no significant differences from the generalist assemblies in subsequent years. This syncopating pattern is similar to what Brüderl and Schüssler (1990) subsequently found among German businesses, and called a *liability of adolescence*. Singh, House, and Tucker (1986: 598) found the mortality rate initially rose sharply to age two, dropped until age four, rose to the maximum mortality rate at age five, declined monotonically to age ten, and then became constant.⁶ Like Brüderl and Schüssler (1990), Carroll and Huo (1988) and Le Mens, Hannan and Polos (2015a), Singh, House and Tucker discovered a liability of adolescence.

Newly-created innovating organizations experience both newness and change. They may not, however, experience the same high mortality rates that some changed organizations have experienced, because innovations tend to occur in contexts of plentiful resources and (perhaps) in home organizations that are less fragile than those of changed organizations. Similarly to older organizations, innovations may not experience increased organizational mortality (e.g. Singh, House & Tucker, 1986). In the public sector, innovation could be expected to have the same liabilities as organizations in other sectors but, in addition, they are subject to political factors much more than those other sectors. As may now be clear, the most substantial information available to assess the four hypotheses is from the organizational demography literature, but it relates to organizations generally, not to organizations that are innovating. More evidence and a full research program are required to understand the effects of innovation on organizations. As Glor (2014) has suggested, the most desirable way to approach this is through the study of innovations and their organizations in varied and numerous ways.

Eventually, innovation research should be able to compare (1) organizational founding and mortality rates for a number of innovative and normal or non-innovative populations, (2) the fates of their organizational (and eventually geographic) communities and (3) mean innovative and normal organizational mortality rates.⁷ Populations studied should be matched or contrasted to those of the same and other historical periods, ideologies, and levels of organization in comparable hierarchies (innovations should be studied from the same organizational level in the given organizational hierarchy (Rousseau, 1985), magnitude, amount of funding and human resources, management and political support, ease of termination, whether or not the innovation was institutionalized and what the rules were for forming and terminating organizations. These results could then be compared to populations with other characteristics, including some factors

⁶ Birth was formal incorporation; death was ceasing to exist as a formal entity. Mergers were counted as deaths: only five mergers occurred.

⁷ We are saying *normal* because we already have that data and thus avoid needing to distinguish and do research on non-innovative populations. This will be contentious. It will, of course, be more difficult to see significant results comparing to a normal population that will have some innovations in it.

identified as relevant to organizational mortality or sustainability, e.g. organizational niche and density (Freeman & Hannan, 1983), newness (Singh, Tucker & House, 1986), resources, size, institutional design (Boin, Kuipers & Steenbergen, 2010), internal and external environment (e.g. politics). New issues should also be considered: for example, in the public sector, does mortality result from a niche closing, from a niche being over-crowded, or something else?

The following hypothesis can therefore be derived:

Hypothesis 4: Innovations increase organizational mortality short-term but reduce it long-term.

A Way Forward

If enough comparable organizations and populations were studied, it should then be possible to assess across countries whether innovation is adaptive for the survival of government organizations. Of course, while survival of an innovating organization is a necessary condition for an innovation to be implemented and achieve results, it is not a sufficient condition for the fate of the individual innovation at individual, group, organizational, and trans-organizational (e.g., political) levels of action, agency, and analysis. Different players will have different objectives, e.g. political leaders may be most interested in whether innovation satisfies key constituencies while organizational leaders may focus on the effect of innovation on organizational efficacy or efficiency. Without survival, however, these objectives cannot be met.

Survival is a measurable result, but the claim that it resulted at least in part from an organization's or a population's innovations or innovativeness must be examined and demonstrated. This paper delineates how this could be done for *public sector* innovations and their impacts on their organizations, organizational communities and organizational populations, largely following a comparative methodology tied to the Glor (2014) analytical framework.

Directions for Future Research

As to future directions for mortality-related innovation research studies, these might profitably focus on organizational, program, and project evaluations across sectors, at various levels of analysis, focusing on such factors such as resource dependence, coordination and control, environmental constraints, regulatory supports and oversight, internal and external legitimacy, networked/collaborative partnerships, and the management of risk. For instance, non-profit agencies are known to be chronically dependent on external funding, such as foundation and government grants. In certain fields like microfinance and informatics, organizational and program or project mortality is typically high, year to year (Taherdoost & Keshavarzsaleh, 2015), with failure often owing to resource flux, and to mismanaged innovation. Fafchamps (2004) found that resource-connected innovation failure is a major reason for market failure in sub-Saharan Africa, along with coordination/control failures.

Coordination and control failures occur frequently among nongovernmental networks, which should but often fail to dampen external threats. Innovation failure predictably occurs when the macro-institutional environment fails to bolster innovation in essential ways, as is the case with the lack of regulatory and resource supports such as credit reporting and credit guarantees for microlending in most developing nations, or when insufficient organizational capacity for innovation leads to failure, for instance, an inability to manage the incorporation of new information technologies (Taherdoost & Keshavarzsaleh, 2015; see case study that follows).

By implication, public managers could deliberately take up resource-generation and structural-change strategies intended to increase the innovation capacity and the rate of innovation adoption and generation in their organizations. Innovation capacity and in general adaptive capacity differ across organizations because these turn on the complex interaction of organizational values, policy and programmatic agendas, resource mobilization sequences, political endowments, stakeholder engagement and support, risk management, and other factors addressed throughout this study. Follow-on research would benefit from study of the role of innovation in large-scale economic and social change along with organizational levels of change. Models for such an approach to the study of innovation are found in Nelson's (1993) proposal for research on *national systems of innovation* and Ogle's (2007) treatment of partnered networks and "value-multiplication." These researchers emphasize the complex links and interactions among numerous organizational actors, in reciprocal influence with a wide variety of social, institutional, and political factors, consistent with the kinds of omnidirectional causation suggested throughout the present study.

Innovation entails risk and exposure to possible failure. Bhatta (2003), among others, has suggested that risk and failure are concomitants of innovation. Others have argued that innovation cannot be planned, but only approached through trial and error (Chintan, Ortt & Scholten, 2006), and that efforts to manage uncertainty may work at cross purposes with the chance-taking required for the relatively spontaneous process of innovation. Relatedly, as do many innovation scholars, Raipa and Giedraityte (2014) speak of the development of risk-averse organizational cultures in the public sector, as public managers strive to control rather than promote what they regard as risky innovation (Mulgan & Albury, 2003). *Innovation risk management* (at organizational levels) and *risk governance* (at inter-organizational and political levels) are often the only strategic options left to these managers (Brown & Osborne, 2013). Task complexity often inclines organizations toward incremental innovations, seen to present less risk to the adopting (and adapting) agency and to fit readily within existing processes, through the device of phased-in, gradual change. However, as the informatics case study that follows suggests, this guarded approach may prove to be more successful than more radical ones.

A commonly-found proposal for effective innovation management and organizational restructuring relates to inter-agency collaborative innovation (Bogers, Afuah & Bastian, 2010). Some researchers see this kind of structuring as dampening innovation and risk-taking—begging the question of when partnered approaches may promote or retard innovation. One determinant may be the costliness of solution searches when returns diminish or turn negative; another is the extent to which the values of public accountability in governmental contexts marked by regulatory control may work at cross-purposes with innovation. Yet another factor, considered in the case study that follows, is that collaboration increases innovation complexity in ways that may threaten project and organizational survival. The research consensus seems to be that mismanagement of inter-organizational innovation can prompt organizational crisis or mortality (Drees & Heugens, 2013; Taherdoost & Keshavarzsaleh, 2015). However, there is, as of yet, no agreement on the general implications of collaboration for organizational viability or survival.

Cross-sectoral similarities noted throughout the foregoing study suggest that research studies of innovation in governmental and nongovernmental settings may inform one another.

However, because of the singular nature of many public sector agencies and programs, intra-sectoral studies may serve as well as do comparative ones in advancing our understanding of the interrelation of innovation propensity, performance, and survival. Reflexive case studies could be undertaken of the same divisions or programs over time, over the organizational life-cycle or the S-curve of innovation adoption and diffusion (Rogers, 1995; Kim, Price & Lau, 2014).

The research question then becomes: In what types or instances of (1) organizational design, (2) organizational structural alignment with directed-change projects, (3) constraining and enabling circumstances (determinants) surrounding organizational development, and (4) inter-agency collaboration and integration, is innovation frustrated or promoted (Lawrence & Lorsch, 1967; Burns & Stalker, 1961; Mintzberg, 1979, Tushman, 1977)? Case analyses could form the basis for testing and generalization of theory along these lines, with factor analysis addressing network density and embeddedness, innovation motivation and risk aversion, innovation adoption and diffusion, project success or failure, and organizational success or mortality. Innovation may overtax organizational process. The relationship among the factors of size, density, and integration with innovation success and organizational survival need to be tested empirically. An apt study is found in Baum and Amburgey (2000), who probe the determinants of survival—notably, *overlap density*—among childcare providers in Toronto. Non-profits overlap when they compete against each other even while they collaborate on joint projects, reflecting strategic similarity (Chen & Hambrick, 1995).

While, with Ogle (2007), we would situate creativity in collaborative partnerships and networks, we also note an oscillation between destructive and constructive phases of innovation among organizations. In this context, Ware (2008) posits that innovation often goes through “specialization and generalization loops.” Branching, overlapping sequences of analysis and synthesis occur until creative innovation obtains. Two outcomes may then present themselves. One is that of paradigm *acceptance* and extension, with flexible refinement and adaptation in innovation, for instance through specialized elaboration of existing organizational processes and practices. The second is that of paradigm *rejection* and replacement, leading to new departures in the crafting of innovations. Testable changes followed by analogical and evaluative comparison, generalization, and phased innovation are common sequences out of the latter (Welling, 2007).

In addition to micro- and meso-levels of analysis (individual to organizational domains), one may focus on inter-organizational linkages as such, when these channel participation in innovation (Engeström, 2001); individuals and groups generate innovation at boundary-crossing points, in role enactments that cross organizations. Creative freedom, felt need for innovation, opportunities for communication within and outside of participant organizations, and (inter)organizational support for novelty production are all key factors in overcoming risk aversion in innovation (Kerosuo & Toiviainen, 2011). However, the coupling of internal and inter-organizational role constraints can hamper innovation. And distribution of innovation initiatives among organizations may increase combinatorial complexity, while rendering innovation more susceptible to institutional and political pressures (Obstfeld, 2005).

Most of the germane literature consists of case studies. Everett Rogers’ seminal work on innovation diffusion, which relied on case studies, laid stress on multi-factor individual and group decisions in innovation adoption (1995: 372), from *optional innovation decisions*

(“choices to adopt or reject an innovation that are made by an individual independent of the decisions by other members of a system”) to *collective innovation-decisions* (“choices to adopt or reject an innovation that are made by consensus among the members of a system”) and *authority-based innovation decisions* (“choices to adopt or reject an innovation that are made by a relatively few individuals in a system who possess power, status, or technical expertise”). Rogers consistently argued and demonstrated that the larger the number and greater the influence of decision makers in innovation adoption, the greater the prospect of innovation failure.

The multi-directional, multi-agency dimensions of causality—whether individual, group, or organizational in origin—needs to be addressed again as Rogers did, preferably in scaled-up research that includes both empirical reviews and case studies (Slappendel, 1996). Author Rivera’s evaluation of successful innovation in a U.S. Department of Energy sponsored STEM education program in northern New Mexico (Rivera et al., 2013) points in this direction, as does research that Rogers did on healthcare informatics and communications with this same author (Rivera & Rogers, 2004; Rogers et al., 2005). The case analysis and research synthesis methods these studies relied on are indicated for future research.

Much as we do, Bozeman (2010) considers organizational restructuring in the public sector (including agency mergers) to be a type of organizational mortality. Mortality may occur even when there is organizational transformation at the end of a spiral of decline. Bozeman considers *managed decline*, with deliberate turns toward innovation, which may then become a factor in organizational rebirth. In the same context, Rivera and Valdez (2007) studied innovation failure in a national research laboratory technology-transfer project, a learning experience which would eventually strengthen privatization programs and bolster managerial capacity there. As the case study that follows suggests, however, such adaptive, situationally-driven innovation may be most beneficial to organizations when it is undertaken strategically, rather than reactively or opportunistically (Rosenbusch, Brinckmann & Bausch, 2011).

In recommending a research agenda, we return to issues of analytical level and method. For instance, population ecology approaches take an essentially macro-analytical perspective on the evolution and mortality of organizations (Hannan & Freeman, 1977, 1984, 1988). The focus is on the variation in resource endowments in the context of organizational ecology, the adaptation of organizational forms to corresponding resource fields—market niches, governmental appropriations, and inter-organizational resource generation. Organizational differentiation follows on such resource endowments. While this organizational-level ecological approach to the study of organizational development and senescence can be an incisive one, it needs to be complemented by case-based institutional- and project-level modes of analysis.

Case studies allow for the finer-grained testing of the broad delineations of organizational mortality of population ecology studies, allowing for exercises in grounded theory and theoretical synthesis (Glor, 2014). The case study that follows suggests that mixed-method, theory-integrative research on the actual impacts of innovation across organizations is essential to knowledge development in the innovation field, consistent with themes in the preceding review.

Exemplifying Multi-level Research: a Case Study of Information Systems Innovation Failure and Recovery in the U.S. Bureau of Land Management and U.S. Forest Service

Project failure in technology-innovation projects may threaten organizational survival, but it can also become a catalyst for renewal, through well-managed restarts (Rivera & Valdez, 2007). In a comprehensive literature review, Taherdoost and Keshavarzsaleh (2015) consider information systems adoption and implementation failures to be the most often-cited type of project failure, tied as it is to organizational viability; case studies are commonly used to explore the causes and implications of such occurrences. As Kim, Price and Lau (2014) argue, case studies may serve as a rigorous, empirical method, particularly with descriptively intricate subjects such as informatics, especially when coupled with large-scale (“large-n”) or meta-analytical reviews. We agree that innovation research would benefit from exploratory and explanative case studies developed against the backdrop of large-scale research synthesis such as that found in this study’s opening systematic review.

Accordingly, the following section undertakes a case study as a complement to the introductory large-scope empirical survey. The case was chosen because it links organizational survival crisis to recovery, and because it develops one possible causal relationship between catastrophic, large-scale project failure and organizational survival in ways that fill gaps in the information systems innovation literature (for a comprehensive review, see Hadrien, 2007). What follows is a historical and analytical study of a major information systems project failure in the United States that triggered both organizational crisis and resurgence. The focus is on the U.S. Bureau of Land Management and its implementation with the U.S. Forest Service of the massive, extraordinarily expensive, and ill-fated Automated Land and Mineral Record System (ALMRS). While this innovation effort failed as it reached the half-billion-dollar mark, scaled-back innovation initiatives rescued the project and agency (Beachboard, 2003).

The Automated Land and Mineral Record System—ALMRS

Information models of innovation-driven organizational development suggest that expanded information processing capacity can increase institutional capability, responsiveness, and innovativeness, although information technology also tends to generate increasingly complex internal and external demands on the information-management and change-management institutional capacities of organizations. This case study, which recounts a partnership between the Bureau of Land Management (BLM) and the Forest Service (USFS) in the joint development of a major, and shared, national enterprise information system, indicates the need for new approaches to the management and evaluation of collaborative information technology projects capable of sustaining organizational innovation (Beachboard, 2003).

An evaluative assessment of the BLM Automated Land and Mineral Record System (ALMRS) undertaken by author Rivera and current BLM Acting New Mexico State Director Robert A. Casias (who drew on direct experience with ALMRS field testing as a manager), posits that, as both internal and external adversity increase, institutional capacity for information systems innovation may also increase correspondingly, even if a given project meets with temporary failure. Somewhat contrary to the previously-cited innovation literature, the authors found in their joint study that resource and regulatory constraints ~~and~~ ~~erises~~ may actually prompt

the development of new organizational capability for informatics innovation and adaptation (Rivera & Casias, 2001).

Driven by budgetary constraints in the 1990's, the BLM and USFS, the largest land management agencies in the United States, addressed the exploding demands of information retrieval and processing by undertaking joint programs for information systems development. The functions of the two agencies overlap significantly in certain program areas requiring capable informatics support: both manage grazing lands, mineral claims, land record retrieval, recreation permitting, energy and mineral leasing, and natural resource endowments. Together with the Fish and Wildlife Service and the National Park Service, they administer more than a fourth of the entire land base of the U.S. National lands management programs commonly involve these various agencies acting in concert. BLM alone administers 258 million surface acres and 700 million sub-surface mineral acres, mostly in twelve Western states (Cone, 2008).

There are many demanding jurisdictional issues between these agencies that are intergovernmental as well as inter-organizational in nature. For example, BLM occasionally relinquishes control of lands either to the other land-managing federal agencies or to the states; when it identifies lands that are "uneconomical to manage" or that impede a community's development. With certain land use claims, BLM develops Resource Management Plans that conform to Federal Land Policy and Management Act planning requirements when conflicting uses require systematic review. And there are also interjurisdictional and intergovernmental demands on the management of preservation and economic development programs. These varied challenges require formidable cross-agency information systems capacity (Rivera & Casias, 2001; Industry Advisory Council, 2002; Beachboard, 2003).

Research suggests that for organizations with interlocking missions and a history of sustained interaction, shared information technology can substantially increase communication and extend collaboration, in keeping with the previously cited innovation literature. Information systems implementation, as an effort to diffuse information technology innovations among user communities, depends on complex technical, managerial, and organizational factor relationships (Beachboard, 2003). Cooperation around ALMRS built on these tasks, for instance with wildland fire policy, which engages several agencies through information networks, not only BLM and the Forest Service, but also the Fish and Wildlife Service, Bureau of Indian Affairs, National Park Service, Forest Service, and Federal Emergency Management Agency (Rivera & Casias, 2001).

BLM began the implementation of the project known by the acronym ALMRS in late 1988. The aim was to develop a system that could effectively link all existing databases into one super database. ALMRS was to replace the enormous paper document and record system maintained by BLM in its land-management mandate. The purposes of the system were seemingly all-encompassing, including everything from public information and sale of documents to recording fees, budgetary and cost recovery programs, human resources data systems, and graphical and text access to Geographic Information System (GIS) databases (Rivera & Casias, 2001).

The task of assessing software requirements and contracting for its development was originally carried out by a team of BLM executives and technical specialists in the mid 1980's. It

recommended building the architecture of the system based on state-of-the-art computer technology available to them at the time along with entirely custom-designed software products. The contract was awarded to both hardware and software vendors, and the heavily-specified initial coding for system software began in 1993. By 1996, software was ready to be pilot tested and evaluated by selected agency users. However, in early testing, it became apparent that some requirements placed on contractors were excessive in light of actual needs. Moreover, the sheer size of the system and the complexity of data processing requirements were not given sufficient consideration in the early stages of system design (Beachboard, 2003; Cody & Gorte, 1995).

As with most government procurement, once a contract has been awarded, the contractor is obligated to perform according to the terms agreed upon at the time of contract finalization. This restrictive developmental tack was taken by the contractors in their first approach to the ALMRS project. After years of testing and redesign, in the early-to-mid-90's a prototype was finally completed which, though consistent with the original contracts, appeared to lack many of the capabilities originally envisioned by the design team. Consequently, the ALMRS software would be delivered in phased release. However, the software proved to be inadequate to the growing storage and retrieval challenges facing BLM, so that additional capability "enhancements" would have to follow (Rivera & Casias, 2001).

BLM reorganized and reintroduced the ALMRS project in June of 1996 by taking what was by then a \$400 million system modernization project and opening it up to other land management agencies, particularly the Forest Service. BLM did so in the face of fiscal constraints as a putative cost-saving measure, envisioning a universal system that would be created through a streamlined procurement process. BLM was spurred to take this action not only because of internal dissatisfaction with the project's pace and progress but also because of outside criticism—on the part of the Congress, the Congressional Budget Office, the Office of Management and Budget, the Office of Federal Procurement Policy, Inspectors General, state officials, advocacy groups, and the media. In 1995, the Congress used an adverse General Accounting (now 'Accountability') Office report to justify cutting the Fiscal 1996 budget line for the ALMRS by more than a fourth, and to threaten to eliminate program funding altogether. The GAO noted ALMRS development problems with slow and inadequate performance which rendered system modernization more uncertain and costly. Field tests indicated higher than expected error rates with the use of an operational database, along with costly preparation of standard reports (GAO 1997; Cody & Gorte, 1995).

In this immediate context, BLM succeeded in securing an extension of the ALMRS project, by characterizing and publicizing it all the more as an inter-agency system, and as an innovative modernization project. Contract extension came at a time when the ALMRS was nearly fully developed, and the software vendor, Computer Sciences Corporation (CSC), was retained despite a difficult tenure (begun in 1993) as prime contractor, and despite challenges from OMB, and Congress to let the contract lapse. Here the BLM acted astutely, since the extension represented only an additional, contingent, \$10 million to CSC between 1996 and 1998, working to hold the company responsible for the completion of the project. BLM used the ALMRS extension mainly to designate USFS anew as system partner. BLM and USFS also made political as well as practical use of their 'co-located' facilities in New Mexico, Colorado,

and Oregon. BLM temporarily salvaged ALMRS at by recasting it as an inter-agency and constituency-service network (Rivera & Casias, 2001; Beachboard, 2003).

By 1995, BLM management realized that contract overspecification limited system adaptability and usability. This difficulty made for a change in managerial philosophy, centered on the perspective of the *user*. BLM managers began to take a new approach to software design, employing *Rapid Application Development*, a strategy used widely in private industry. It requires that specifications be broadly defined by users and redefined and re-specified only as a project moves forward; it favors rapid prototyping over extensive planning. The user is closely involved in the development of the software, and system needs are defined as they are encountered. Decisions are made more spontaneously and at ground level, rather than mandated long in advance of implementation (Beachboard, 2003; Rivera & Casias, 2001).

The lesson learned through years of development and evaluation eventuating in unsuccessful field-testing in the state of New Mexico, is that a system of this size should have been designed incrementally from the start, with the implementation of each component program building on the cumulative success of the previous ones. The magnitude of land data alone made it certain that the lands component of the ALMRS system would require more time for redesign than anticipated in 1996, when the phased approach was introduced. BLM managers came to realize that plans made years before implementation are unequal to the demands of large-scale information systems (Rivera & Casias, 2001). In most respects, however, such information technology endeavors are similar to other large-scale organizational initiatives—systems failure falls on organizations as much or more than on technology (Vandenbosch & Huff, 1997: 81).

The scale and complexity, as well as extent of prior specification, of ALMRS project components in the contract with CSC was unprecedented. Moreover, the project's launch occurred without the elaboration of necessary systems management and data-sharing standards among land management agencies. For BLM, the combination of (1) rapidly increasing information system responsibilities and rapidly expanding software demands after 1995 with (2) continued reliance on outsourcing to one vendor, CSC, would prove to be critical to the eventual failure of ALMRS (Beachboard, 2003; Rivera & Casias, 2001).

Faced with these challenges, BLM turned in 1996 to a more decentralized, participatory, and incremental process of system development, confirming Lewis's (2002) contention that organizational change follows from policy change. Here, Congress imposed the policy change. The ALMRS program was therefore modified, so that an Assistant Director for Minerals, Realty and Resource Protection was designated "System Owner"—consistent with contemporary prescriptions in the literature for an executive sponsor for major informatics projects, along with the engagement of prospective users (Belcher and Watson, 1993; Singh, House & Tucker, 1986).

CSC was allowed to remain the lead software contractor under the direction of the National Information Resources Management Center (NIRMC) in Denver. BLM's New Mexico State Office was designated pilot site during the testing period, with Release 1 of ALMRS (for land ownership and status records) and a more capable Release 2 (for land use planning and environmental analysis) field tested in 1998 and 1999. Following them, New Mexico, Arizona, Idaho, and Colorado were to implement ALMRS, followed by California, Nevada, and

Wyoming, and then Oregon, the Eastern States, and Alaska. A NIRMC User Support Plan provided guidance on the establishment of support groups and networks. An Automation Help and User Group (AHUG) for ALMRS modernization was expanded to include other automated systems and programs. It relied on a network of *superusers* and dedicated technical staff from the National, State, and District or Area Offices. A NIRMC Rapid Response Team for New Mexico provided orientation and troubleshooting assistance during the ALMRS pilot phase, dealing particularly with software testing problems. All states were scheduled to begin ALMRS implementation in 1998 and 1999, which necessitated the creation of state-by-state user-support groups (Rivera & Casias, 2001).

State Directors appointed Program Leads, Deployment Coordinators, and ALMRS Coaches for these activities. These traveled to New Mexico to observe and/or help with the demonstration phase of the project, anticipating that, as their states became incorporated in the national ALMRS system, their own ALMRS implementation would become subject to close federal oversight. A “train-the-trainer” approach was to prepare BLM, Forest Service, other government and industry users, and eventually the public, for ALMRS. In consultation with user groups and with the help of a network agency “sponsors” and a Departmental Management Advisory Group, BLM established Use Authorization Redesign Teams to manage pilot trials. User participation was becoming increasingly important for the ALMRS rollout in fact as well as in rhetoric (Rivera & Casias, 2001; Industry Advisory Council, 2002; Beachboard, 2003).

Notwithstanding these efforts, which were consistent with state-of-the-art practices, there was reason to doubt that the ALMRS would be equal to the tasks of (1) delivering information services to states, localities, private firms, non-profit agencies, and the general public and (2) serving as the principal internal and inter-agency information platform for complex record retrieval and analysis. Unexpectedly high levels of task complexity made for programmatic overcommitment and therefore for the often drastic underestimation of needed resources. As Tait and Vessey have found, using a contingency approach, high system complexity and constrained resources available are related to information system failure, when the two causal factors coincide (Tait & Vessey, 1988). Structural contingency theorists consider the interplay of several additional factors, in this regard: (1) organizational fit with externally-determined demands on innovation and information (March & Sutton, 1997; Mitzberg, 1981; Tushman & Nadler, 1978); (2) managerial choice (e.g., in defining internal incentives) driving organizational fit (Donaldson, 1996); and (3) lateral devices such as boundary-spanning roles and cross-functional teams, within and across organizations (Lawrence & Lorsch, 1967; Tushman, 1977).

The uneven movement toward decentralization, and a lack of articulation between user-led testing and contractor development of software, would come to bedevil ALMRS in its final field-testing and deployment phases. The lack of sufficient integration of the software development and testing tracks of ALMRS would overwhelm a newly-evident capacity at BLM for participatory system development. What cooperative programs did materialize may have arisen from the designation of the BLM as one of thirty two Reinvention Impact Center agencies under phase 3 of the Clinton-Gore (Presidential) National Performance Review (NPR). An Inter-agency Steering Team engaged field offices during the pilot phase of ALMRS, with an NPR-derived reform philosophy of promoting innovation where agencies were closest to the public, aiming to meet both high-priority public needs and fiduciary responsibilities. A 1998 BLM

Service First Report listed at least three major areas of concern: complex technical problems, barriers to inter-system communication, and difficulties associated with devising a single set of inter-agency regulations when dealing with the public (Rivera & Casias, 2001).

It is evident that collaboration among these agencies in the joint development and field-testing of ALMRS software, and their effort at resource sharing, were catalysts for new alliances between the BLM and the USFS, consistent with the innovation literature (Drees & Heugens, 2013). While the ALMRS was being put to the use of client service, it was also slated to function in cross-agency decision support, with an eventual goal of the integration of GIS and expert systems in a national resource land information system, with capabilities in data management, spatial analysis, and mapping, among other functional areas. A system prototype was intended to coordinate BLM automated resource data bases, in support of automated data retrieval and analysis. Despite these efforts, serious doubts arose among these agencies and their federal authorizers as to whether ALMRS was equal to its myriad functions. By the end of Fiscal Year 1999, BLM anticipated the development of protocols enabling other agencies and state and local governments to use ALMRS, which entered into data exchange agreements with BLM despite acknowledged system limitations (Rivera & Casias, 2001).

The accumulation of new system requirements and expectations was overwhelming. When BLM and the Forest Service adopted the NPR customer-service mandate, there followed the rapid accumulation of new clientele obligations. Uninterrupted adoption of new commitments would simply overload the ALMRS. While accepting increasing responsibility and new constituencies made sense in view of NPR obligations and Congressional scrutiny, it was ill-advised to expand ALMRS functions in view of the lack of articulation of the central and decentralized systems that began to grow alongside one another. There were also signals from field tests of ALMRS that it could not satisfactorily respond to routine records-retrieval demands, even while it was capable in other instances of delivering on more sophisticated uses. In the end, contractor-controlled software development of the ALMRS, combined with an overload of ever-growing system demands, would prove to be its undoing.

The failure of ALMRS tests (manual records retrieval was faster than automated record generation, in field-testing) prompted Congressional intervention, making it difficult for BLM management to gauge a course for future system development. Even in its most decentralized or segmented stages of participatory, user-engaged development, ALMRS remained an overgrown and overambitious system. Disagreements developed between field office teams—users involved in piloting and testing efforts—and project office teams administering the project. In early beta tests (field tests of software in final development), users voiced their displeasure in regard to the validation and correction of land records data in particular (Rivera & Casias, 2001).

Although BLM management was cautioned not only by users but also by an independent contractor/evaluator, Mitretek Systems, that ALMRS had not demonstrated the ability to perform well in operational environments, the final Operational Assessment Test and Evaluation (OAT&E) was allowed to go ahead as scheduled in October 1998. The OAT&E was intended to find if (1) the ALMRS system was operationally suitable for deployment, and (2) BLM was ready to operate and maintain the system. A key finding on the part of Mitretek was that many of the software problems which had been identified in earlier testing had resurfaced. In its final

evaluation, Mitretek found that the results of testing called into question the operational readiness of ALMRS for deployment, particularly with respect to (1) difficulties with the approach taken for implementing the graphical user interface and (2) the inability of the ALMRS to provide the functions actually required by the system's users (Beachboard, 2003; Rivera & Casias, 2001).

As a consequence of these software testing problems, the BLM decided in January 1999 to allow the ALMRS contract with CSC contract to expire. Tests conducted in November 1997 encountered workstation failures due to insufficient computer memory and problems with two BLM-developed software applications. As a result of the eventual OAT&E evaluation, and of adverse Congressional testimony and media coverage concerning testing failures, BLM announced that it had suspended development of ALMRS (United States General Accounting Office, 1998). The Acting Director of BLM indicated in contemporary testimony and press briefings that BLM had reached an understanding with the Office of Management and Budget and Congressional committees to assess what went wrong with ALMRS and to define a series of realistic corrective options (Rivera & Casias, 2001).

BLM was therefore presented with four possibilities (ones that were not mutually exclusive): (1) further modification of the software, (2) modification of existing ("legacy") record systems, (3) acquisition of commercial software, and (4) development of entirely new systems. The key legacy software applications and records residing in ALMRS and elsewhere at BLM were moved by mid-1999 to a "Legacy Rehost 2000" networked computer system expected, together with a National Integrated Land System, to succeed ALMRS (Tillett, 1999).

Rescuing BLM and ALMRS—the National Integrated Land System (NILS)

NILS started with separate, modular functions, handling parcel and survey information, and it would be phased in piecemeal but steadily, in cumulative stages that included a Geographic Information System-based *GeoData Model*, a *Measurement Management Extension* (a compatible set of tools to move data across platforms), a *Parcel Management Extension* (a custom set of parcel record management tools), *GeoCommunicator* (a subscription website service for land managers, extended to other users and the general public), and *Survey Management* (consisting of automated field data collection software functioning with commercial surveying equipment and software packages to capture field measurements and metadata directly into a GIS database). The intent in the design and deployment of these modular systems was to minimize the need for data conversion due to software incompatibilities, and to maximize the use of newly commercially-available software, in particular GIS software.

AHUG approached both information-systems and business-process reengineering by incorporating critical concerns from a broad base of both internal and external users and constituencies, with the aim of wider support and acceptance. A strategy called *Managed Evolutionary Development* introduced a modular, incremental system design-and-development strategy, building clearance steps and checkpoints where user needs could be weighed against risk and also resource availability, in contrast to the "grand design" philosophy of ALMRS development efforts (Rivera & Casias, 2001). Contrary to innovation research literature cited in the preceding section, risk-minimization through incremental phase-in proved essential to this restorative innovation phase, countering losses in external legitimacy (Brown & Osborne, 2013).

This case study suggests that disjointed or out-of-step inter-agency collaboration can increase the information- and innovation-management burdens of partnering organizations, precipitating failure; however, integrative, aligned collaboration can create capable, flexible frameworks for innovation. The greater the uncertainty and intensity associated with innovation, the greater the need for collegiality and collaboration, consistent with the research literature (Rivera & Casias 2001; Beachboard 2003). As Stuart Bretschneider has noted approvingly, “promoting collegiality among stakeholders through workshops, site visits, and public meetings, as the Bureau of Land Management did in creating its National Integrated Land System, was seen by the Industry Advisory Council (2002) as a key success factor” (Bretschneider, 2006: 394). This sort of engagement increased substantially in the post-ALMRS transition to NILS. There were tangible benefits to greater intergovernmental collaboration under NILS, as exemplified in Colorado, “[where] the program provided clarity regarding geographical areas in Durango County that were, in fact, not Federal lands,” but erroneously designated that way; as a result, “the county was able to open ‘new’ areas/addresses that could provide additional tax revenues” (Industry Advisory Council, 2002).

The extraordinarily high costs of information system development and implementation can frequently only be offset by the cooperative sharing of resources through collaborative networks, as the ALMRS case illustrates and the innovation literature finds (Drees & Heugens, 2013). It was only when the ALMRS came under the GAO’s critical scrutiny in 1995 and underwent punitive budget cuts in Fiscal 1996 that the BLM began cooperating much more visibly with the Forest Service. By then the BLM itself was under threat of Congressional receivership. The promise of resource-sharing would be politically advantageous to BLM for a time, again consistent with the previously reviewed innovation literature. However, termination of ALMRS created a survival crisis for BLM which would only be reversed with a deliberate turn toward modular, incremental informatics development (Beachboard, 2003; Cone, 2008).

In 2001, the former ALMRS Communications chief and Release-2 Manager (Denver-based BLM officer Leslie M. Cone) was serving as Project Manager (sponsor) for the successor National Integrated Land System (NILS). NILS was launched in 1998, immediately upon the shutdown of ALMRS. Cone had successfully led BLM’s Legacy Rehost Project and also led much of the effort to introduce team-based management. As Cone put it, the goals of the NILS were to provide integrated spatial data, in “a common solution for the sharing of land record information within the government and the private sector;” from the outset, NILS was a “partnership with states, counties, and private industry to develop a common data model and a set of software tools for the collection, management, and sharing of land survey data, cadastral [map/survey] data, and land record information” (2008: 1). The much more resilient, incremental, and yet strategic approach to information systems development and to innovation management that Cone relied upon would prove to be a lasting one at the BLM.

Cone explained NILS as follows. “Commercial off-the-shelf (COTS) GIS technology formed the foundation of NILS along with custom object-oriented (OO) software” (Cone, 2008: 4). Standardization of data models and applications on a true enterprise systems architecture was anticipated to be beneficial to BLM, partnering agencies, and the general public alike. “Since user requirements and data capture requirements will change over time, the NILS architecture has been designed to accommodate those changes,” and “use of COTS software ensures that

NILS will be maintainable” (Cone, 2008: 5). As an example, the NILS portal, *GeoCommunicator* (available at www.geocommunicator.gov), was developed using—adapting—commercial off-the-shelf software provided by the Environmental Systems Research Institute, Inc. (GAO, 2003).

Today, the National Integrated Land System is a robust, capable, segmented system with a greater number of applications than those envisioned under ALMRS. The NILS successfully integrates BLM and USFS functions, handling data for federal lands, land and mineral use records, mining claims, and survey, parcel, and measurement management. There are streaming services for BLM National Conservation Areas, BLM Wilderness Areas, BLM Wilderness Study Areas, and BLM Areas of Environmental Concern. New capacities and functions have been made possible by the explosive growth in the capability of commercial as well as customizable software purchased and adapted ‘off-the-shelf’ from industry.

Cone acknowledged at a 2002 forum of the American Society for Public Administration’s Center for Accountability and Performance that BLM “could have done more marketing” around NILS (ASPA, 2002). However, the gradual development/release strategy proved very successful. There were also unexpected salutary developments. For instance, Cone indicated, BLM “had more partners who wanted to be involved in the initiative than they had originally anticipated, particularly international partners” (ASPA, 2002: 2). Today, the list of component NILS applications is a long one, evidence of the value of cumulative innovation that obtained after the Congress cut ALMRS funding and Cone took the reins of NILS as Project Manager and National Applications Deputy for the program.⁸

The case study supports Hypothesis 4 in the preceding analysis: *Innovations increase organizational mortality short-term but reduce it long-term*. The sequence was as follows. A major external crisis following an overambitious innovation effort precipitated threats to agency survival, but it also helped trigger innovation management changes that would restore its viability. What the information systems literature calls the “locus of innovation” in fact became the *sustained* partnership between executive sponsors and system users (Love & Vahter, 2014).

In the years leading up to the termination of ALMRS, BLM had proclaimed its intention to develop this system in partnership with the Forest Service while responding to a growing list of constituencies, stakeholders, and users. In reality, BLM turned to the USFS partnership (and publicized it) in earnest only with the 1996 Congressional intervention that sharply cut funding for ALMRS, but by then it was too late to save the system. Software design alone had absorbed over \$400 million, and the total cost including computer workstations and other investments

⁸ National Integrated Land System components and linked programs include the following (list not exhaustive):

1. *GeoCommunicator*: sponsored by BLM and the USFS, publication site for the NILS. A *Township GeoCoder* GIS-based mapping/survey and records system uses Public Land Survey System data in *GeoCommunicator*.
2. *Geographic Coordinate Data Base* (BLM): Public Land Survey System records and other source documents.
3. *LR2000 Geographic Reporting*: A system legacy from the post-ALMRS transition.
4. *ArcGIS*: NILS transactional platform for creating and maintaining Survey, Parcel, and land-development data. A related platform, *ArcIMS*, is the NILS publication site for viewing, querying, and downloading data.
5. *FSGeodata Clearinghouse* (US Forest Service): Geospatial data sets and metadata for national forest lands.
6. *National Conservation Lands Program* (BLM): develops online recreational guides.

approached a half billion U.S. dollars (over \$750 million today, adjusting for inflation), with little to show for it. The Bureau of Land Management became exposed to continued Congressional scrutiny, even while manager/leaders like Cone (at the national level) and Casias (at the state level) turned to a phased implementation of modular components in developing the successor NILS system (Cone, 2001).

That the NILS became a marked success over the next twenty years pointed to the wisdom of the more incremental, participatory—and partnered—approach to informatics design, development, and implementation that Cone helped inaugurate. BLM itself withstood not only scrutiny but also an onslaught of political controversy over land management practices as well as regulatory policies in the intervening decades, for instance among Western ranchers over grazing rights, and among farmers and other landowners over conservation and preservation protections. Some critics have faulted the BLM for not doing enough, for instance environmental activists who call for more vigorous regulatory action over hydraulic fracturing (*fracking*) in oil exploitation. Channeled through Congressional champions, these persistent criticisms have forced the agency to very visibly respond to constituency demands. And the movement toward a robust inter-agency informatics platform has cemented alliances that appeared to be more a matter of political positioning in the early '90's (Rivera & Casias, 2001).

This shift in the case study account—the movement from truncated to well-aligned innovation—provides concrete evidence for Hypothesis 4: *Innovations increase organizational mortality short-term but reduce it long-term*. In light of the case, a caveat may be added to this proposition, subject to further testing and confirmation: *if catalytic situational transformations and the necessary strategic determinants and supports obtain*. The causal sequence appears to be (1) a critical inflection point at which the organization is confronted with a threat to its survival; (2) a measured, guarded response to this threat that is nonetheless substantive (here, the modular implementation of successor technologies); and (3) strategic consolidation of gains in innovation management. As the case makes evident, information systems innovation failure is as much or more about organizational capacity and adaptability as it is about the capability of any one technology.

At the time of this writing, in 2016, NILS approached a critical turning point. User demands had begun to outstrip system capabilities by 2010, according to an audit report of the Department of the Interior Office of Inspector General (OIG, 2010). The *Report* noted an “increasingly complex environment of complicated transactions, legal challenges, and deteriorating difficult to access land records,” adding that with its numerous components, NILS “was not adequately integrated or automated” (OIG, 2010:12). Congressional scrutiny coincided with previously-noted protests from Western land interests to call into question NILS capabilities (despite support from the Western Governor’s Association and other stakeholders)—this time for insufficient integration, rather than over-specification or over-centralization as with ALMRS. Costs were an important issue, but less so than with ALMRS: NILS had only cost \$27 million by 2010 (OIG, 2010: 12). After eighteen years, NILS “is no longer supported from Washington,” though “follow on components” will be deployed; “*Navigator* for example will replace *Geo-Communicator* [in 2016]” (Casias, 2016). Funding will become BLM’s responsibility, presumably through revenue-generating activities such as leasing and sales. Going forward, BLM will have to attend to both the stepwise development *and* continuous integration of

commercially-procured and custom-made geospatial systems, in a new and increasingly demanding cycle of informatics innovation.

Conclusion

This study has proposed how the impact of innovation on organizational survival could be researched, identifying factors determining the effect of innovation on government organizations, with an emphasis on the effect on organizational mortality, along with methodological means suited to this line of research. The impact of innovation on survival cannot be determined through one research program in one country or one type of organization, however. Rather, it⁹ needs to be assessed in numerous government organizations and populations before conclusions can be drawn, as was done with normal population mortality rates (Glor, 2013), which allowed identification and elimination of outliers.

The exploration of the effect of public sector innovation on organizational mortality is a question at the center of a research agenda that requires agreement on the meaning of terms such as innovation, innovative organization, organizational community and innovative population; founding and disappearance; and agreement on appropriate methodologies and measures. To assure that studies are comparable, researchers should coordinate their efforts and adopt common research frameworks, concepts, theories, definitions, methodologies and measures. Researchers need to be conscious of the definitions used by others and explicit about the meaning of theirs. Using standard definitions, research will be clearer, and relationships and theories can be tested across studies.

Comparison of organizations, organizational communities, organizational populations and countries would be possible if common definitions and research protocols were used. Some research programs on innovation leadership (e.g. LIPSE, available August 19, 2016 at: <http://www.lipse.org/home>) and innovation in local government (e.g. Australian Centre of Excellence for Local Government, available December 31, 2015 at: <http://www.uts.edu.au/research-and-teaching/our-research/public-policy-and-governance/about-institute/about-acelg>) have been conducted (funding has ended for both). To our knowledge, none is being done on the effect of innovation on the mortality of organizations, organizational communities and/or organizational populations. There is close interconnection between innovation leadership and a supportive organizational culture, structure, and environment, which may be brought together in particular instantiations in given organizations and organizational partnerships (Glor, 2001a, b).

When the mortality of innovating organizations and populations has been identified and compared to the normal baseline for the mortality of government organizations established by Glor (2013), it should then be possible to assess whether innovation is adaptive for organizations, and to identify the positive/negative correlations between innovations/innovative organizations/communities/populations and the demography of their survival/mortality. Researchers should create longitudinal databases of innovative government organizations, communities and

⁹ The reader is referred to the Volume 17 Issue 1, 2012, of *The Innovation Journal*, a *Special Issue on Collaborative Innovation in the Public Sector*, edited by Eva Sørensen and Jacob Torfing; there the pivotal role of collaboration in sustained public sector innovation is explored in depth. It should be noted that a Canadian project contemporaneous with ALMRS underwent similar phases of system crisis and restoration—the Income Security Redesign initiative.

populations. There is no equivalent in the public sector to the private sector European longitudinal Community Innovation Survey (CIS) (e.g. Evangelista & Vezzani [Italy], 2010; Sappasert & Clausen [Norway], 2012), but there should be. Lessons learned include: (1) Identify the information needed early on: it is more difficult to find it decades later; (2) Track the programs, policies and organizations over time. Accomplishing this would be easiest if a single organization was designated to collect the information, as opposed to a researcher trying to find it after the fact. A long-term funded research project would be helpful.

To explore the effect of innovations on their organizations, organizational communities and populations, researchers require: (1) An ability to distinguish innovations, innovative organizations and innovative populations from normal/non-innovative ones; data is already available on normal populations but not non-innovative ones. (2) Agreement that innovators are early adopters and that laggards solely catching up to normal are not innovative organizations. Judgement must be used when the organization is both innovating and catching up. (3) An understanding of the factors involved in organizational survival and more (this requires in-depth interpretive and correlation research, and mixed methods, including case studies). (4) Databases of innovative organizations, communities and populations, including dates of founding and disappearance from the record.

Going forward, researchers need to make the case that (1) an innovation had an impact on an organization's survival, and (2) that organizational and population survival was related to an organization's innovativeness in whole or in part, rather than to other factors such as leadership or political selection (although these may be operative as well). Researchers should develop and maintain databases of innovations, innovative organizations, organizational communities and innovative populations (governments) in such a way that they are comparable to existing databases of normal or non-innovative organizations, communities and populations. As argued earlier, in our proposal for future research, innovation in practice entails evaluative comparison and research synthesis. So, too, does innovation research, in building a comprehensive body of applicable knowledge using the widest applicable mix of methods.

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