NS6
A New Synthesis of Public Administration

COMPILATION OF LITERATURE SCANS

Project Leader's Team

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ABOUT THE NS6 RESEARCH PROGRAM AND NETWORK

Initiated by the Honourable Jocelyne Bourgon[1], the NS6 project aims to propose a *"new synthesis" in public administration*. The goal is to draw on the experience and insights of senior public officials, researchers and experts in six countries[2] to coalesce key traditions and conventions, existing theories and practices, and emerging ideas into an up-to-date frame of reference that public administrators can use to guide their complex, challenging work.

This research does not intend to produce a 'grand theory' or 'model' that serves in all circumstances. It will incorporate and explore: the broad range of roles and instruments available to governments; the search for higher-order public policy results and the quest for civic results; the drive for innovation and learning to improve performance and to deal with emerging issues and seize opportunities; the need to become more capable in the face of complexity, uncertainty, unpredictability and risk; the need to foster resilience.

ABOUT THE LITERATURE SCAN SERIES

The research program for the project calls for an exploration of various topics. A series of papers from the project leader's team reports out on some of these topics to support discussion and debate within the international network.

ABOUT THE PROJECT LEADER'S TEAM

The project leading team is responsible for coordinating the efforts of the network of international partners in the initiative. This team currently consists of Jocelyne Bourgon (President of Public Governance International and President Emeritus, Canada School of Public Service), Marie Sassine (Visiting Assistant Deputy Minister, Canada School of Public Service), Peter Milley (Senior Advisor, Canada School of Public Service) and Jocelyne Comeau (Administrative Coordinator). For more information on the project, see http://ns6newsynthesis.com.

[1] See http://www.jocelynebourgon.ca. Jocelyne Bourgon is supported in this research by the Center for International Governance Innovation, the University of Waterloo and the Canada School of Public Service.

[2] The countries involved include Australia, Brazil, Canada, The Netherlands, Singapore, and the United Kingdom.

LITERATURE SCAN #1:

On the need for a new synthesis of public administration

Project Leader's Team

April 15, 2009

1. INTRODUCTION

Since its inception, the field of public administration has undergone a number of significant changes. In the last three decades, public administrators around the world embarked on a remarkable journey of experimentation and innovation in response to changing circumstances and public expectations. During this period, public sector reforms have swept the globe. Many of these reforms aimed to make public servants and their organizations more efficient and productive. Some strove to make governments more flexible and adaptable to emerging issues. Others aimed to rebalance the respective roles and responsibilities of the public sector, the private sector, civil society and citizens (Bourgon, 2008).

These transformations nevertheless represent an incomplete journey. Public sector organizations are not yet aligned with the dynamic, new global context or with the complex problems they have for their missions to solve (Bourgon, 2007). The models, concepts and solutions on offer in the field of public administration have not kept pace with the innovations and changes that have occurred in practice and with the needs of practitioners (Kettl 2000). A variety of promising, new concepts has been developed, but the connections between them are unclear and their sheer number generates confusion. A new synthesis of theory and practice in public administration is needed to provide meaningful guidance for practitioners.

2. THE RATIONALE FOR CHANGE

The debate among and between academics and practitioners about the development of the field of public administration and the shape of future public sector reforms has been heated in the last decade. Even where the focus of the debate has been the future of public administration, no consensus or unified approach has emerged.

An overview of the literature on this topic reveals *five distinct groups of studies* that provide direction and rationales for the future theoretical and practical development of the discipline. These groups include: (i) the need for a new insight into the field that would reflect the socio-cultural and structural changes arising from *globalization*, (ii) the need for a new *multidisciplinary approach* to the field, especially in terms of integrating *complexity theories*, (iii) the need for

new approaches to *service delivery*, (iv) the need for new approaches to the field of public administration due to the incapability of traditional public administration--in particular, traditional bureaucratic organizations--to cope with the *changing circumstances*, and (v) the need for new approaches to public administration due to the *inadequacy* of the *New Public Management* (NPM) paradigm to reflect entirely the ongoing changes.

(I) THE NEED TO EMBRACE CHANGES BROUGHT BY GLOBALIZATION

This stream of the literature sets out the need for a new theory of public administration that embraces the socio-cultural and structural changes brought on by globalization. Baltodano (1997) and Luke (1992: 15) argue that due to globalization the administrative machinery of the modern state is quickly being transformed into a "spreading network" of subtle and direct interconnections and interdependencies that enmesh public administrators from one part of the planet to another. The interconnections and interdependencies manifest themselves in the organizational structure of the state apparatus, its policy-making process, its organizational character, and its management. The transnationalization of the state apparatus creates tensions and contradictions between the liberal concept of the modern state, with its emphasis on domestic responsiveness and accountability, and the economic imperatives of the global economy. The result is a "crisis of authority" arising from the state's inability to respond to its domestic needs and demands (Baltodano, 1997: 625).

Theoretical capacity needs to be developed that can elucidate the relationship between these socio-historical changes and public administration. One possible route to pursue is to consider the administrative state as one of several interrelated social systems that constitute the totality of a nation state, including government, administrative state, political and economic systems. The functioning of each system within this totality is simultaneously affected by the functioning of all other systems (Morgan, 1997).

Huddleston (2000), among others (e.g., Khator 1994; Khator and Garcia-Zamor, 1994), points out that the globalization process is hollowing out the state, inducing crises of accountability, competence and legitimacy in public administration. In order to prepare better for an increasingly interconnected, global context, they argue that the field of public administration and its members must:

- Recognize interdependence and the fact that no issue will ever again be fully local (Huddleston, 2000);
- Build bridges to partners abroad, sharing ideas and best practices, especially through information technology (Huddleston, 2000);
- Learn from other systems, in part by rediscovering comparative administration and embracing the international component of public administration (Khator and Garcia-Zamor, 1994); and
- Reject traditional management practices rooted in hierarchy, autonomy, representativeness, and other "passé by-products of the industrial era" in favour of flat, networked, and responsive global styles" (Khator 1994: 93).

Finally, Rondinelly and Cheema (2003) highlight that in a changing and complex global society there are few certainties on which governments can base their policies and that fewer universally applicable solutions to problems that will arise in an uncertain world. The 21st century will be an era of increasing global economic, social and political interaction in which states will have to play new and different roles than they have in the past.

(II) THE NEED FOR A MULTIDISCIPLINARY APPROACH

This stream of literature highlights the need for embracing a multidisciplinary approach in studying public administration, including the adaptation of complexity theories to the field.

Dobuzinski (1997) argues that public administration is in ferment today. The positivist certainties of a few generations ago no longer provide the solid ground upon which the discipline can grow. In adopting ideas from business administration, the new public management theorists skipped too lightly over the differences between the public and the private sectors. And there is a need to embrace complexity as part of a multidisciplinary approach in studying public administration. Complexity theories represent a promising point of convergence of new scientific thinking in the social sciences, and offer theorists of post-bureaucratic organizations and reformers a potential wealth of insights. They could help to generate new and better understanding and add to the analysis of public management phenomena, governance processes and organizational behaviour which are inherently complex and dynamic (Tiesman and Klinj, 2008).

Kettl (2000) emphasizes that in the middle of the twentieth century traditional public administration theory found itself under attack by academics and practitioners because it provided weak guidance. The elegance of the theoretical solution of traditional public administration broke down in practice on a number of fronts. For example, in terms of the strict separation that was conceived between policy and administration, elected officials showed strong instincts to delegate not just technical issues but also important policy questions to public administrations. Elected officials also learned they could intervene selectively in the administrative process to adjust both the policies and the details of implementation. This meant that public managers could not necessarily use their discretion and authority to control administrative action. Such disparities between theory and practice posed a serious problem for administrative theory. While theorists produced ideas and suggested trade-offs, they could not provide a straightforward solution. Disparities also posed a problem for practice. They led to less self-assured recommendations by analysts and less eagerness by elected officials to take the advice. These two dilemmas became even more serious as the social sciences sought to become more rigorous and public officials faced greater complexity in the policy issues that confronted them. As part of a solution, Kettl points out that there is an urgent need for a new insight into public administration.

Hood (1990) and Rhodes (1991) argue that public administration must develop an explicitly theoretical approach, evaluating the strength and weaknesses of the several theories. Hood claims, “there is a need to undertake comparison, juxtaposition, and synthesis of different ways of understanding or predicting patterns of public service provision” (120). While Rhodes suggests that “along with this multi-theoretic approach, we need methodological pluralism; setting out our own research agenda and not following governmental whim…and defending public bureaucracy as one among several ways of effectively delivering services” (550).

Haveri (2006) observes that modern societies have developed an increasingly specialized, professionalized and expert-based approach to solving public problems, which does not always work on the complex, even wicked problems societies face. While terminal solutions to these problems may never be found, addressing them requires the engagement and dynamic interaction of the wide range of actors involved and affected, and on the emergence of political leaders willing and able to take responsibility for reforms. From this perspective, governments may have reached the limits of rational, clear-cut reforming and are in a transition to a new era of uncertainty and various modes of

governance. The complexity of problems in society is seen as the impetus for new approaches to governance and new knowledge bases for public management.

Finally, Salamon (2002: 6) highlights that a "dense mosaic" of policy tools exists in most spheres of policy, which puts public agencies in complex, interdependent relationships with a host of other actors. This development means that public managers have more options at their disposal to tailor public action to the specific nature of public problems, but it also complicates their work. Policymakers must likewise weigh a far more elaborate set of considerations in deciding not just whether, but also *how,* to act, and then how to achieve some accountability for the results. Existing concepts of public administration and public policy offer little help in coming to terms with these dilemmas. Traditional public administration remains preoccupied with the internal operations of public agencies--their procedures for staff recruitment, budgeting, and task accomplishment. Even the 'new public management' and the 'reinventing government' movement that it helped to spawn have failed to improve much on this record. Thus, according to Salamon, "the great challenge now is to find a way to comprehend, and to manage, the reinvented government we have produced" (8).

(III) THE NEED FOR A NEW APPROACH TO SERVICE DELIVERY

This group of studies emphasizes the need for a new approach to service delivery. Osborne (2009), for example, points out that public administration entered into a new paradigm which he called the New Public Governance (NPG) that is both "a product of and a response to, the increasingly complex, plural and fragmented nature of public policy implementation and service delivery in the 21st century" (3). NPG is rooted firmly with organizational sociology and network theory and acknowledges the increasingly fragmented, complex and uncertain nature of public administration. This theory allows researchers and practitioners to understand service delivery as a dynamic system where organizations and users interact to co-produce public services. The central resource allocation mechanism of these service systems is the inter-organizational network, with power and accountability being negotiated at the inter-organizational and inter-personal level within these networks.

In another example, Bovaird (2006) describes how the multiple relationships that exist between service clients in the public sector and other stakeholders mean that service clients may often co-produce public services such as social welfare

programs with others in their communities. The traditional conceptions of the 'market' and of 'market management' are now outdated and need to be revised to take into account the potential of collaborative relationships between multiple stakeholders in the public domain. There is a need to reconceptualise market exchange "as a process of social construction, in which actors in self-organizing systems negotiate rules, norms and institutional frameworks, rather than taking the 'rules of the market' as given" (82).

(IV) THE NEED TO BANISH OR RE-INVENT BUREAUCRACY

This strand of research suggests that the traditional model, and in particular its reliance on bureaucratic organizations, is not capable of coping with the emerging challenges, many of which are messy and cut across the vertical structures of traditional forms of administration. The general lines of argument in this group lie at two extremes: those who see bureaucracy disappearing or wish to banish bureaucracy and those who believe that bureaucracy will (or should) survive or argue for the re-invention of bureaucracy.

Osborne and Plastrik (1997: 64) derive strategies of how bureaucracy and the public provision of goods and services might be banished. They define a five Cs strategies – Core, Consequences, Customer, Control, and Culture – as the "change efforts that rewrite the genetic code" of organizations. In addition, Rhodes (1997) also describes how "governance without government" is becoming the dominant pattern of public management. In Rhodes' opinion, societal actors have become influential over policy and administration where as governments are seen as weakened and as less capable of directly steering public policy implementation than they were in the past. Finally, Peters and Pierre (1998) argue that the traditional concept of government as a controlling and regulating organization for society is outmoded.

In contrast, Hales (2002) observes that there are frequently asserted claims in public management that centralized, regulated bureaucratic organizations characterized by hierarchy and rules are inevitably giving way to decentralized and empowered post bureaucratic organizations characterized by internal networks and an internal market. As a consequence, the traditional managerial role of command and control is being superseded by one of facilitation and coordination. Hales argues that these claims often rest on caricatures of bureaucracy and network organization and are neither new nor supported by evidence. Despite claims about decentralization and empowerment, organizational change may entail not a radical shift to network organization,

but a more limited change to a different form of bureaucracy in which hierarchy and rules have been retained but in an attenuated and sharper form, which he calls "bureaucracy-lite" (52).

Olsen (2005) states it is time to rediscover bureaucracy as part of a more holistic vision for public administration that includes market organization, network organization, and bureaucracy. These three forms of organization are usually portrayed as alternatives, based respectively on hierarchical authority, competition, and cooperation. In modern, pluralistic societies with a variety of criteria of success and different causal understandings, it is, however, unlikely that public administration can be organized on the basis of one particular form of organization. Bureaucracy, therefore, is not the only way to organize public administration for every type of task and under all circumstances. Bureaucratic organization is part of a "repertoire of overlapping, supplementary, and competing forms coexisting in contemporary democracies, and so are market organization and network organization" (18).

Meier and Hill (2005: 422) argue that bureaucracy will not only survive in the 21st century but will flourish. Their core argument is that governments will still need to perform many of the large-scale, relatively stable and predictable tasks that they have in the past, and that bureaucracies--likely public but possibly private, or some hybrid combination--will continue to be the "most effective way" to do these tasks.

Kettl (2002) asserts that bureaucracy's key strength lies in coordinating complex operations. However, "coordination in the 21st century raises a host of new problems, and no bureaucracy can completely encompass, manage, or control any problem that really matters" (45). The solution lies not in dismissing bureaucracy but in addressing how it can be adapted to the changing circumstances.

(V) THE NEED TO RE-CONSIDER NEW PUBLIC MANAGEMENT

This group of studies addresses the perceived inadequacies of the New Public Management (NPM) paradigm going forward into the 21st century.

While Manning (2000) and Savoie (1995) argue that NPM is a slippery label and flawed concept, Dunleavy (2005) points out that it represents the dominant set of managerial and governance ideas of the last two decades in most advanced industrialized nations. According to Dunleavy (2005), some NPM

practices are deeply institutionalized, and a minority of its elements are still actively developing, but the NPM has essentially "died in the water" (468) and key parts of its reform message have been reversed because they lead to "policy disasters" (468). Others observe that a post-NPM wave of management thinking and practice is currently underway. Hood and Peters (2004), for example, believe that the NPM has entered 'middle age', with scholars now moving to the evaluation of it.

In terms of evaluation and analysis, some authors (Denhart and Denhart, 2000; Frederickson, 1999) point out that those challenging the NPM have been asking questions about the values promoted by it. Terry (1998), for example argues that managerialism inherent in the NPM has threatened to undermine democratic and constitutional values such as fairness, justice, representation, and participation. Peters and Savoie (1996) focus on the tensions between the emphasis on decentralization and deregulation promoted in the market model and the implications of the privatization movement for democratic values and public interests. But Denhart and Denhart (2000) observe:

Beyond these separate critiques, what is missing is a set of organizing principles for an alternative to the NPM. The notion that the reinvented, market-oriented NPM should only be compared to the old public administration, which despite its many important contributions, has come to be seen as synonymous with bureaucracy, hierarchy, and control. If that is the comparison, the NPM will always win. Instead the NPM should be contrasted with a set of ideas about the role of public administration in the governance system that place citizens at the center (550).

Wise (2002) emphasizes that the focus on the NPM style of reforms may have distorted the understanding of theorists and practitioners of the evolution of public management practice, as this focus gave too much credit to one model as the basis for understanding and undertaking public-sector reforms.

The direction of public management practice cannot be seen as fully determined by any one approach to government reform or as traveling in only one direction. Understanding the balance among competing drivers of change is a key to interpreting both contemporary and future administrative reform (555).

Finally, Rhodes (1997), and Bovaird and Löffler (2003) argue that while the NPM is still receiving a lot of attention, it seems that governance is rising to become a more and more important model to describe changes in theory and practice

and as a guide for reforms. In this perspective, a new "self-aware public administration", both in practice and in theory, is moving toward theories of cooperation, networking, governance, and institution building (Frederickson, 1999:702). This emergent public administration has a new language and its own unique voice. This language is distinct from the dominant theories of public administration in the sixties, seventies, and eighties, which featured decision theory, market or public choice theory, and policy analytic theory respectively.

3. THE KEY ELEMENTS OF A NEW INSIGHT

There seems to be a growing requirement for new theoretical insights in public administration to usefully guide the actions of practitioners in facing the challenges and dilemmas of serving citizens in the 21st century. These new insights would help practitioners understand the interactions that are increasingly necessary amongst citizens, civil society, the private sector, public servants and elected officials in achieving democratic results and public results. This need for re-conceptualization of the field is driven by: (i) the socio-cultural and structural changes brought to the world by globalization, (ii) the insufficient connections of public administration with other disciplines necessary to advancing the field, (iii) the outdated mechanism of traditional public service delivery, (iv) the incapability of traditional public administration model to cope with the changing circumstances, and (v) the inadequacy of new public management paradigm to reflect entirely the ongoing changes.

The new global context is characterized by unpredictability, uncertainty, multiple actors, interconnectedness, dispersed responsibilities, and increasing complexities of various issues. These developments, which are perhaps not new but are now being more fully recognized, are pushing academics and practitioners to explore beyond the known boundaries of theory and practice in public administration. The unpredictable nature arises primarily out of *multitude and dispersed interactions* in a networked society. There are an increasing *number of places* where in society people, groups or organizations make important decisions (Castells, 2000). As a result there is increasing fragmentation. Each actor has a limited impact. At the same time people, groups and organizations' decisions are influenced by the decisions of others and by the expectation of what others may do, as a result there is growing dependency. Fragmentation and dependency increases uncertainty because of the unpredictable nature of interactions in a networked society (Koppenjan and

Klijn 2004). It is in this context that governments are called upon to address complex issues. The challenge for public sector leaders is to redefine the role of government and to build the institutional capacity required to help citizens cope with uncertainties (Rondinelly and Cheema, 2003).

This context also pushes governments *beyond hierarchy* as a broad dispersion of responsibilities in society and the coordination of complex operations constitute the trademark of government activities. It challenges governments to experiment *beyond direct service delivery* with indirect means of delivery. It pushes governments *beyond the provision of services to citizens* as an increasing number of public policy issues require the active contribution of citizens in creating common public goods. It pushes governments *beyond borders of the traditional concept of the stat*e towards a dynamic open system where organizations, services and users interact.

In this new global context, the question arises as to how the hierarchical, authority-based public organizations and management systems created to meet the challenges of the industrial age fit with the increasingly dispersed system of relationships and shared responsibilities that are needed to respond to citizens' needs and expectations in the 21st century. The role of government and the role of the public service are being transformed in ways that push beyond the constraints of both the traditional model of public administration, which the NPM paradigm served, in part, to deepen and extend (Bourgon, 2009). It exacerbated the separation between politics and administration, and thus between policy development and implementation. It disaggregated, rather than linking and interconnecting, the administrative machinery. And it extended the bureaucratic rationality of top-down command and control through other means, such as contracting and detailed performance measurement. As a result, practitioners are left without the benefit of a unifying theory of public administration that is able to coherently address an increasing number of complex issues in an unpredictable and globalizing world (Bourgon, 2007).

Kettl (2002) summarizes the challenge:

Public administration without a guiding theory is risky; administrative theory without connection to action is meaningless. That dilemma is the foundation of a genuine intellectual crisis in public administration (17).

Thus, the time seems ripe to develop a "new" synthesis of public administration, which, in turn, raises the important question as to what key elements from existing and emergent theories and practices should inform this synthesis.

At present, there is no single dominant theory of public administration and 'grand theories' are seen to be a thing of the past. Past, current and emergent approaches and solutions in the field do not point in the same direction. Theorists are engaged in debates amongst themselves about which approaches are potentially most useful. These debates are not close to resolution. In addition, all approaches on offer to reform public administration are not entirely developed. The theorists themselves acknowledge that significant gaps remain in their arguments and that far more research needs to be conducted. This implies that the field of public administration needs to consider its guiding ideas (and practices and reforms) in a dynamic way. This seems to be a reasonable course of action, given that the plethora of complex problems point to the need for public administration to be adaptive and open to emergent possibilities. A "new synthesis" should be static and should not strive to be dominant or all-encompassing. But it should provide a broad space in which a wide range of ideas can be connected, recombined and invented, always with due regard to history, convention and, most importantly, practice.

There does, however, appear to be an agreement in the literature that a new theoretical insight should focus on the broad range of roles that governments have played and have the option to play going forward. As hierarchical authority has not evaporated, it is necessary to identify how the field can incorporate its continued importance, including how to adapt it or complement it with other organizational forms to meet the challenges of an uncertain, interconnected world. It is also important to identify the various roles and relationships that are necessary between governments and citizens when multiple actors are involved in achieving complex public policy results in contexts characterized by uncertainty and unpredictability. The other element is the policy-administration dichotomy that has been outlined by the classical model and given renewed emphasis by the NPM to promote efficiency. It is necessary to identify what new faces the policy- administration dichotomy will need to present in order for better policy outcomes to be achieved while respecting it as one of the democratic that have served many societies well to the present day.

There is also a major consensus in the literature that one of the key elements in a new synthesis is an approach that conceives service delivery as a dynamic

system able to correspond to changing needs and emerging challenges and opportunities. This would have direct implications to the design of effective public service delivery systems, sustainability, accountability and the role of citizens in these systems.

The literature reviewed here reveals a general consensus that public administration needs to be repositioned. It implies that a new theoretical insight needs to make connections for practice. This insight should also incorporate multidisciplinary approaches to public administration, in particular the further adaptation and refinement of complexity theories. Although limited so far, there is already some movement in that direction as theorists try to illustrate how non-linear dynamics could be used to study administrative behavior. Complexity theories may allow the field to understand better the non-linear nature of problems and issues and the dynamics of individual, organization and collective behaviors. They offer potential for analyzing and promoting change in public administration.

In addition, there has been an agreement among various scholars that governance with its focus on horizontal ways of steering that involve multiple actors in addition to government should be part of any new theoretical approach because of its promise of improving both public policy results and democracy--or at least its ambition to re-establish the link between politics and citizenry (Koopenjan and Klijn, 2000).

Finally, as public administrators try to address extremely complex issues that cannot be easily reduced to economic or statistical modeling, theoretical insights are needed that are based on empirical studies which apply new concepts as means to describe and or evaluate the effects of actual programs or institutional arrangements.

4. CONCLUDING THOUGHTS

In addressing the future of the field of public administration there is a growing consensus among academics and practitioners about the need for new theoretical insights and new directions for public sector reforms. To some extent, there is also a growing consensus about what these reforms should focus on or what elements should form part of a new insight into the discipline of public administration. In other words, the '*why*' and '*what*' of future directions have been explored. However, left largely unexplored is the "*how*". In particular, what

left unsaid is (i) *how* to move forward on theory and in practice, and (ii) how to integrate or make sense of the range of existing and emergent theories in the context of practice.

Taking into consideration that new theoretical insights into the discipline require a high level of integration among various theories and concepts, future research should focus on: (i) developing practical mechanisms for integrating key elements into a concise synthesis to ensure their relationships and interactions are mapped, (ii) identifying missing elements, and (iii) ensuring that an open-ended, dynamic approach to theory-building and public sector reforms is pursued.

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LITERATURE SCAN #2:

Complexity theories: What are they and what do they tell us about public administration in the 21st Century?

Project Leader's Team

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SUMMARY

Public administration is a complex subsystem operating in an increasingly complex and interconnected world. This paper explores some of the key concepts of complexity theory and how they have been applied to management, organizational science and public administration.

Definitions of complexity vary, but foundational concepts related to complex systems include non linearity, unpredictability, multiple systems of interaction, the emergence of temporary order out of seeming chaos, and mutual causation.

The field of complexity science is informed by conceptual inputs from biology (adaptation and evolution), chemistry and physics (non-equilibrium thermodynamics), and economics (increasing returns and path dependency). This paper reviews these concepts as a preface to exploring other complexity theory concepts that scholars have identified as useful in analyzing social phenomena. Specifically, the literature suggests that connectivity and interdependence, adaptation and co-evolution, self-organization and emergent properties, and feedback and mutual causality may prove useful for studying public administration.

The paper then draws out some implications of these ideas for public administrators who are tasked with managing in the face of complexity and uncertainty. These include:

- Administrators should accept complex phenomena and emergent properties as an inevitable part of their organizations and societies and begin to manage accordingly;
- There is a need to complement traditional approaches with an acceptance of shifting dynamics that emphasizes practical and appropriate, rather than perfect or correct, approaches
- As complements to traditional hierarchies and top-down governance, networked and horizontal forms of coordination are needed to help governments anticipate risks and account for evolving conditions;
- Administrators should make more room for pilot projects and other forms of experimentation that advance adaptation, learning, innovation and evolution;

- Administrators should aim for ‘smart interventions’ that establish timely and appropriate connections between actors and issues in order to promote patterns of interaction and behaviour that can contribute to more desirable outcomes;
- Administrators must develop an acute awareness of the context or terrain of the system to take advantage of emerging situations.

Questions remain for further research such as what complexity means for accountability, due process and rule of law or for performance measurement. More explicit discussion of *how* practitioners can work with these concepts would also be useful and welcome.

1. INTRODUCTION

A number of scholars have observed that the public administration takes place in an increasingly complex, interconnected world (Klijn 2006), in which public administrations themselves can be seen as complex subsystems. As a result, scholars and practitioners have recently been turning to complexity theories, developed in other fields over a number of decades, in order to enrich thinking and practice in public administration (Ho 2008; Rhodes 2003).

This paper provides the findings from a scan of some of the primary and secondary literature on complexity theory, including the application of complexity concepts to aspects of public administration. The purpose of this scan was to identify and briefly describe:

- some of the key concepts in complexity theory,
- the major ideas adapted from complexity theory into the organizational and management sciences, and
- how some of these concepts and ideas have been taken up in the field of public administration.

In addition, some consideration was to be given to how the findings might affect current thinking about a "new synthesis" in public administration.

2. DEFINITION

Complexity science is far from cohesive. There is no consensus regarding definitions of 'complexity', its basic principles and conceptual approaches to understanding it (Morçöl 2001). Nonetheless, there are some common features that appear across the literature. Writing within the organizational theory field, Morgan (2005) offers a cogent description of complexity thinking:

Complex nonlinear systems like ecologies or organizations are characterized by multiple systems of interaction that are both ordered and chaotic. Because of this internal complexity, random disturbances can produce unpredictable events and relationships that reverberate throughout a system, creating novel patterns of change. The amazing thing, however, is that despite all the unpredictability, coherent order always emerges out of the randomness and

surface chaos...Whether we are examining the flocking of birds...the development of weather patterns...complex chemical reactions...or the way in which organizations and social systems get transformed over time, it seems that we can detect common processes of spontaneous self-organization. If a system has a sufficient degree of internal complexity, randomness and diversity and instability become *resources* for change. New order is a natural outcome. (263 italics in original)

Those working on complexity science, including those who are adapting it to the social domain, tend to see it as diverging from traditional, Newtonian (or positivist) science (Morçöl 2001). Table 1, which is based on the work of Dent (1999) and Rasch (1991), describes these perceived differences in outlooks.

Table 1: Divergence between Newtonian and Complexity Science

Newtonian Science	Complexity Science
reductionism	holism
objective observation	perspectival observation
linear causation	mutual causation
entity as unit of analysis	relationship as unit of analysis

Complexity science calls attention to *context*. It tends to reject broad generalizations from specific observations on the understanding that many events and properties in complex systems are *emergent* and often *unpredictable* (Holland 1998; Morçöl 2001). As a result, it has been argued that the continuing dominance of Newtonian thought in public administration and policy and related areas is not in sync with the recent developments (Morçöl 2005a: 4) and that complexity theory offers to fill some of the gaps in knowledge that prior positivist worldviews may have omitted (Weber 2005).

Debate exists as to what role complexity theories, derived largely from within the physical and natural sciences, should play within the social sciences, including organizational theory and public management. The approach social scientists have tended to take is to adopt particular elements, themes, or concepts from the complexity sciences as metaphors or analogies, using them in an attempt to

provide deeper, more robust or practical understandings, while not directly adopting and applying the theories in their entirety (Haynes 2007; Morgan 2005). According to Mitleton-Kelly (2003), "the theories of complexity provide a conceptual framework, a way of thinking, and a way of seeing" that can help to explain and understand "the nature of the world—and the organizations—we live in" (4).

3. CONCEPTUAL INPUTS

The concepts relating to complexity are derived from a tapestry of theories that have developed in a number of scientific fields, including non-equilibrium thermodynamics from chemistry and physics, "algorithmic complexity, deriving largely from computer mathematics; and organizational complexity, deriving from the new biology and a revivified systems theory" (Stewart 2001: 326), with the latter taking on a distinctly anthropological flavour as they have been adapted into the organizational and management literature (Morgan 2005).

3.1 BIOLOGY – ADAPTATION AND EVOLUTION

Starting from the premise that the molecules, cells, complex organisms, species, and nature can be seen as parallels to individuals, groups, organizations, classes of organizations, and their social ecology, ideas stemming from biology have played a major role in steering organizational theory since the 1970s (Morgan 2005). General systems theory (see von Bertalanffy 1968), which is strongly influenced by biology, suggested that the universe largely can be seen as comprised of *open systems* and *sub-systems* that interact with one another, evolving and trending towards disequilibrium (Morçöl 2005b) or multiple potential points of equilibrium. These ideas have contributed to a better appreciation of how organizations, including public administrations, are "non-linear, subject to system pressure, shocks, chance events" (Klijn 2006: 2).

The concepts of evolution and adaptation have allowed social scientists to observe that different 'species' are better suited to particular environments. Similarly networked forms of organization, for example, are viewed as more effective in turbulent, uncertain contexts, while bureaucracies are seen to fit predictable and stable ones (Koppenjan & Klijn 2004). Drawn from complex adaptive systems theory, ideas about the adaptive and maladaptive cycles that occur at different scales in ecological systems have been used to think

about the health and resilience of organizations in the complex ecology of their broader natural, social and economic contexts (Holling 1986, 2001; Morgan 2005).

3.2 CHEMISTRY AND PHYSICS – NON-EQUILIBRIUM THERMODYNAMICS

A key conceptual input to complexity thinking is that of *dissipative structures*, which comes from non-equilibrium thermodynamic theory (see Nicolis & Prigione 1989; Prigione & Stengers 1985).[3] This concept describes "the ways in which open systems exchange energy, matter, or information with their environment and which when pushed 'far-from-equilibrium' create new structures and order" (Mitleton-Kelly 2005: 10).

Mitleton-Kelly (2003) uses the example of convection cells to describe these structures. When a thin layer of water is placed between two larger plates and kept uniformly at room temperature, the water will tend to a homogeneous state. When heat is applied to the bottom plate (and the temperature at the bottom of layer of water is higher than at the top) at a threshold temperature the fluid becomes unstable, with the molecules moving in seemingly random fashion. If the temperature differential is further increased, at a critical point the liquid transforms into a new structure of small, right- and left-handed convection cells—a new, order arises out of molecular disarray (Mitleton-Kelly 2003). This new coherence is composed of two different solutions (i.e., right- and left-handed cells).

This example offers some specific insights regarding the behaviour of a system, which also pertain to the study of highly complex phenomena such as the relationships between atmospheric and oceanic circulation and weather patterns (Nicolis & Prigogine 1989):

- an external constraint or disturbance pushes a system 'far-from-equilibrium';
- when the constraint reaches a certain level, there are different paths the system can pursue to adjust to its new environment (these paths

[3] A related concept is *conservative structures*, which, though they may change structure, those changes are reversible. For example, a snow crystal will revert to water or steam when the temperature is altered (Mitleton-Kelly 2003: 20).

are referred to as ‘bifurcation points’, though there are usually many more than two possibilities available at any time);

- the constituent parts of the system spontaneously ‘self-organize’ into a certain configuration, often pursuing multiple courses of action simultaneously;
- the system behaves in a coherent manner, despite the random motion of its constituent parts; and
- that other potential solutions are not selected suggests the system has a ‘memory’ and ‘history’ that will affect its further evolution (Mitleton-Kelly 2003).

It is also important to note that in far-from-equilibrium conditions, non-linear relationships tend to prevail and complex systems become very sensitive to external influences. Very small perturbations under these conditions can create very large transformations. An incremental change may trigger a series of other small changes, one of which has a ‘catalyzing’ effect that alters the entire system. As a result, complex systems can be seen to self-organize “through unpredictable leaps into different system states” (Morgan 2005: 265).

Social scientists have used insights from non-linear thermodynamics to think about organizational change processes and management practices. Morgan (2005), for example, argues these discoveries should prompt managers to “rethink what [they] mean by organization, especially the nature of hierarch and control…learn how to use small changes to create large effects [and] live with continuous transformation and emergent order as a natural state of affairs” (266). Mitleton-Kelly (2003) observes that, in attempting to transform organizations, managers can “deliberately create constraints and perturbations that consciously push [an] institution far-from-equilibrium” (14) and open up spaces of possibility where new ideas, relationships and structures can be explored. One of the lessons the concept of dissipative structures offers mangers that are intent on creating new ways of working is that “they may block or constrain emergent patterns of behaviour if they attempt to excessively design and control outcomes” (Mitleton-Kelly 2003: 14).

However, if organization re-design were to concentrate on the provision of enabling infrastructures (the socio-cultural and technical conditions that facilitate the emergence of new ways of organizing), allowing the new patterns of relationships and ways of working to emerge, new forms of organization may

arise that would be unique and...more robust and sustainable in competitive environments. (Mitleton-Kelly 2003: 14)

But organizations that are pushed well beyond their established ways of doing things can also "degrade into disorder" (Mitleton-Kelly 2003: 16) and damaging forms of instability that threaten organizational survival (Stacey 1995).

3.3 ECONOMICS - INCREASING RETURNS AND PATH DEPENDENCY

The concepts of increasing returns and path dependency, drawn from economics, have contributed to an understanding of complexity in the social domain. Arthur (1990, 1999) observes that conventional economic theory provides an incomplete and inaccurate reflection of economic reality because they do not account for the dynamic complexity of economic systems that are always in process, constantly evolving and unfolding over time, often in unpredictable ways. Economic agents (individuals, firms, governments, investors, etc.) co-evolve as they "react with strategy and foresight by considering outcomes that might result as a consequence of behaviour they might undertake" (Arthur 1999: 107).

According to Arthur (1990), conventional economic views are based on the assumption that economic actions eventually produce negative feedback that leads to a predictable equilibrium which represents the 'best' outcome possible under the circumstances. For example, strong demand generates high prices (a positive feedback relation); while high prices serve to weaken demand (a counteracting negative feedback relation) thereby producing lower prices (a predictable shift towards equilibrium). Conventional economics couches this negative feedback dynamic under the concept of 'diminishing returns'. As prices rise, firms may make higher profits for a time, but in the long run they should have fewer customers and their returns should fall back towards equilibrium.

In contrast, Arthur (1990) observes that "in many parts of the economy, stabilizing forces appear not to operate" (92). Instead, positive feedback processes and 'increasing returns' feature prominently. In addition, there appear to be multiple and unforeseeable points of equilibrium. Furthermore, "there is no guarantee that the particular economic outcome selected from among the many alternatives with be the 'best' one" (Arthur 1990: 92). Chance economic forces can cause a particular path to be selected which then becomes 'locked in' (a positive feedback relation) regardless of the

advantages of other available paths (which represent potential sources of negative, or stabilizing, feedback). For example, if one nation "gets ahead by 'chance' it tends to stay ahead and even increase its lead" (Arthur 1990: 92). As a result, economic systems are, in many ways, dissipative:

- there are multiplicities of potential "solutions" or economic outcomes;
- the outcomes eventually reached are not predictable in advance;
- outcomes are subject to historical paths already taken—they are path dependent;
- outcomes reached are not necessarily the most efficient economically (i.e., the most efficient use and allocation of resources); and
- equal starting points for economic agents do not lead to equal end points—their outcomes are asymmetrical (Arthur 1999).

A complexity approach is seen to offer a framework for understanding the indeterminacy that characterizes them.

These insights have begun shaping policy approaches in government which avoid the extremes of directly coercing desired outcomes or remaining strictly laissez-faire, and instead aim to encourage the system to move towards a generally desired state. This involves "not a heavy hand, not an invisible hand, but a nudging hand" (Arthur 1999: 108). In addition, path dependence and *increasing returns* have been used in public administration to describe the "lock in situation of...governments or the trajectory in which governance institutions are formed" (Klijn 2008: 3).

3.4 CHAOS THEORY

Chaos theory has also served as a key input for understanding complexity. It is often associated with the famous 'butterfly effect', whereby "a butterfly flaps its wings in Brazil and a storm results in Texas" (Haynes 2003: 30). Another way of saying this is that small changes—random non-linear events—can result in very large effects over time in complex systems (Gleick 1987). While patterns of behaviour, such as weather patterns, may be observed in complex systems, specific behaviours are never repeated in exactly the same way (Morgan 2005). Thus, "the word 'chaos'...captures the reality that we will never have enough

knowledge of how the tiny details of things relate to larger features – hence our world and our understanding of it are in apparent chaos" (Haynes 2003: 30).

Perhaps paradoxically, chaos theory also attempts to understand order, and the evolution and emergence of new order, in the midst of disorder. This is a key reason why it has proven attractive to complexity theorists. It provides insight into how, in complex systems, "emergent order co-exists with disorder at the *edge of chaos*" (Mitleton-Kelly 2003: 22). Put another way, it reveals how "disorder is…critical to the development of order (Kiel 1994: 45).

Chaos theory has, for example, focused on the way complex systems tend to fall under the influence of different types of 'attractor patterns' that "ultimately *define the contexts in which detailed system behaviours unfold*" (Morgan 2005: 263). Some attractors pull a system towards equilibrium, while others can flip it into completely new configurations (Stacy, Griffin & Shaw 2000). The specific behaviour of a system depends on which context—or set of attractors or influences—is dominant at a given point in time. When a system is 'at the edge of chaos' it "encounters 'bifurcation points' that are rather like 'forks in the road' leading to different futures" (Morgan 2005: 265). Here, the system may cohere into different states, often through rapid and unpredictable leaps (Stacy, Griffin & Shaw 2000). Bifurcation points and associated attractors exist as latent potentials within complex systems, signaling the capacity for new form (Haynes 2003).

Social scientists have drawn from chaos theory to develop insights into organizational behaviour, management, governance and public administration. Haynes (2003), for example, describes how the 'edge of chaos' idea provides insight into the "interaction of two large public sector organizations, like the [National Health Service] and local government, as they attempt to…develop methods for partnership working" (31).

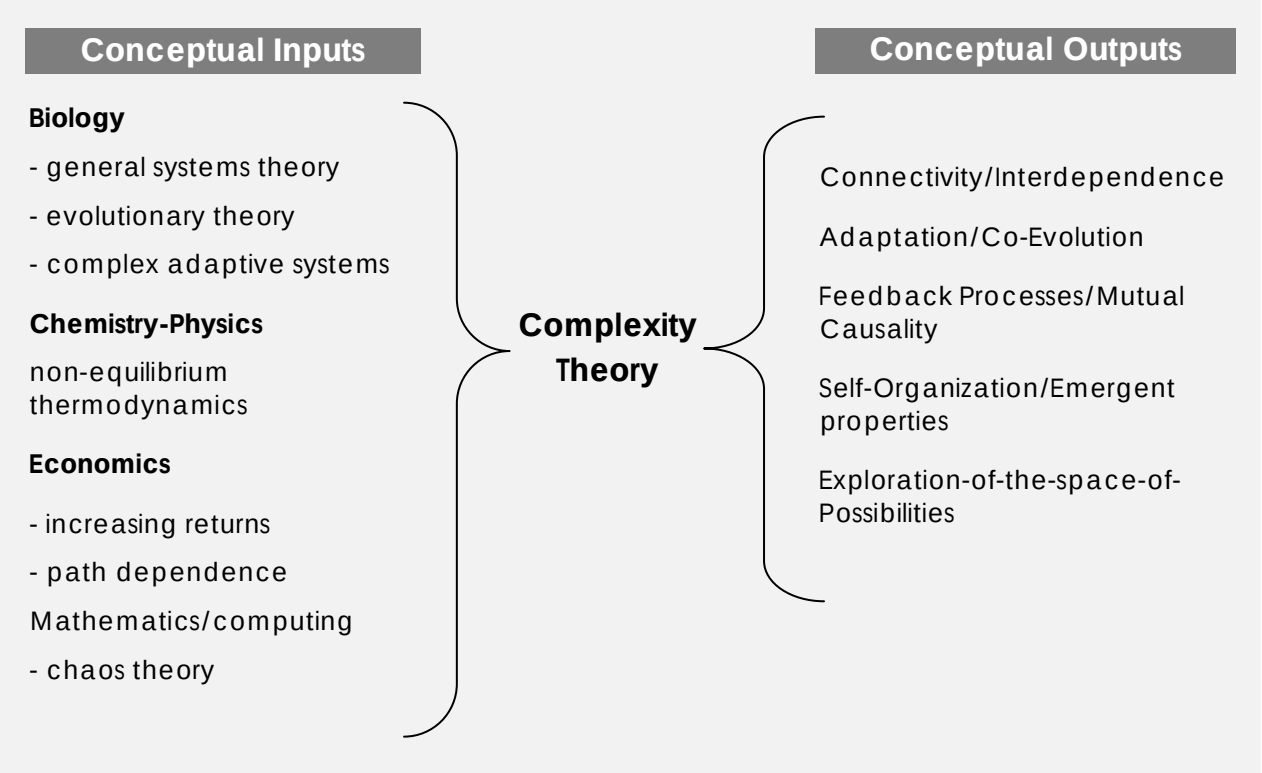
Chaos theory has influenced ideas about complex systems but it is not synonymous with complexity theory. The detailed differences cannot be explored here (see Stacey, Griffin & Shaw 2000). In essence, chaos theory attempts to identify the core algorithms or rules of interaction, which pertain to, and are iterated across, all levels of the system, guiding its complex behaviours (Mitleton-Kelly 2003); whereas, complexity theories tend to see different levels or scales in systems which operate as nested subsystems that adapt, evolve and display emergent properties on their own and in relation to the larger system (Hollings 2001). As Mitleton-Kelly (2003) states, "in chaos theory the iterated

formula remains constant, while *complex systems may be capable of adapting and evolving*, of changing their 'rules' of interaction" (22).

Finally, it may be problematic to apply chaos theory directly to human systems, as it is still debatable that human behaviour is prone to exhibiting central mathematical algorithms in particular because "humans have cognitive abilities that may enable them to change their rules of interaction" (Mitleton-Kelly 2003: 22), unlike other entities.

4. CONCEPTUAL OUTPUTS

Figure 1: Conceptual inputs and outputs of complexity theories



Authors in the social sciences have identified a number of central concepts arising from complexity theories, which offer promise in analyzing social phenomena, including complex forms of organization such as governance systems and public administrations (Klijn 2008; Wagenaar 2007). Figure 1 above, which is adapted from Mitleton-Kelly (2003), lists some of these concepts.

4.1 CONNECTIVITY AND INTERDEPENDENCE

Complex behaviours within a social system can be seen to stem, in part, from the interaction and interconnectedness of actors within it. Complexity also arises through the dynamic relationships between a social system and its environment, including ecological, economic and other social systems. As a result, *connectivity* and *interdependence* represent key features of complexity (Mitleton-Kelly 2005). In the increasingly networked societies that characterize the 21st century, the actual or anticipated actions or decisions of one actor, group, organization, institution or human system may affect related (and even seemingly unrelated) actors and systems, often in unequal, inconsistent or unforeseen ways (Kopperjan & Klijn 2004). Impacts may be mutual, and they vary according to the past and current state of actors or systems, including their history, constitution, structure and, in the case of human actors, intentions, meaning-making processes and goals (Haynes 2003; Mitleton-Kelly, 2005; Stacey, Griffin & Shaw 2000).

In complex systems, there are shifting and varying degrees of connectivity and interdependence; the geometry and density of relationships—and their quality, strength and mutual influences—fluctuate dynamically over time. In addition, actors in complex systems can change the rules of interaction and act on local knowledge without knowing (or needing to know) what the rest of the system is doing. As a result, parts of the system can be self-maintaining and self-repairing (Mitleton-Kelly 2005).

Given the emphasis governments, businesses and even elements in civil societies have placed on connecting the globe, and the emphasis on increasingly networking organizations, it is important to note that complexity theory does not prescribe ever-increasing interconnectivity and high levels of interdependence. More connections and dependencies can lead to wider and more uncertain impacts which may not be beneficial to parts of the system or the system as a whole (Mitleton-Kelly 2005). Improved conditions in one part of a system may impose costs in other parts of that system or related systems.

4.2 ADAPTATION AND CO- EVOLUTION

One of the key features of complex systems is their ability to adapt and evolve. The idea of adaptation is very familiar to organizational and management theorists. It basically suggests that managers and their organizations need to

continually revise their strategies and reorganize in order to respond to changing conditions in their operating environment. This notion rests on the idea that a clear distinction exists between the organization and its environment. The complexity sciences, however, do not tend to see such clear boundaries between systems and their environment. Rather, the trajectory of developments in complex systems has increasingly come to be viewed as a process of *co-evolution*, whereby the adaptations of one actor or entity are at least partially dependent on adaptations among related actors and entities (Mitleton-Kelly 2003, Stacey 1996).

Through co-evolution, the actors or entities change, as do the relationships between them and the 'landscape' which they inhabit. There are multiple, mutual influences—often at different scales—that are both direct and indirect (Klijn 2008). Seen in this light, managers and their organizations can both influence and be influenced by the broader "social ecosystem" (e.g., consumers or citizens, other organizations, economic, cultural and legal institutions, the natural environment) and their strategies "cannot be seen simply as a *response to* a changing environment…but as adaptive moves" which can change the organization and aspects of its environment simultaneously (Mitleton-Kelly 2005: 9). Applied to the social domain, all actors have the potential of exercising influence and causing change to occur in the social ecosystem. As a result, a "subtler 'sensitivity' and awareness of both changes in the environment and the possible consequences of actions" may be needed, along with "a deeper understanding of reciprocal change and the way it affects the totality" (Mitleton-Kelly 2005: 9).

4.3 SELF-ORGANIZATION AND EMERGENT PROPERTIES

Another common feature of theoretical approaches to complexity is that systems are seen to have *self-organizing* capabilities (Klijn 2008, Ho 2009). This means that entities or actors in them do not only behave according to known laws and principles, prescribed rules and scripted relationships (Stacey 1995). They also act in new, sometimes unpredictable ways, recombine in surprising new relationships, and spontaneously create new structures and order (Kauffman 1993). Self-organization allows for a "co-evolutionary process whereby the individual entities and the macro-structures they create through their interactions, influence each other in an ongoing process" (Mitleton-Kelly 2003: 20). Such processes become particularly apparent when constraints push

and hold the system in a far-from-equilibrium state (Nicolis 1994; Stacey 1995, 2001).

That complex systems display these self-organizing tendencies is, not surprisingly, viewed as a sign of their capacity for change, adaptation and evolution. From a biological perspective, both self-organization and natural selection are necessary for evolution (Kauffman 1993)—a finding that Stacey (1995) adapts to study how human organizations succeed or fail in dynamic, complex environments. It is important to note there are "conserving" forms of self-organization that leave room for the system to return to a previous state of equilibrium as well as "dissipative" forms, which transform the system more permanently (Mainzer 1996). In addition, self-organization processes do not, in themselves, guarantee that new states of the system will be functional (Stacey 1995). Their outcomes are unpredictable (Klijn 2008) and can be maladaptive (Hollings 2001).

The term *emergence* refers to the process by which new patterns or structures—that is, new order or coherence—arise out of the seemingly chaotic and random interaction of the individual elements of a complex system. These new qualities of a system are called *emergent properties*, which can only be observed at the level of the 'whole' system even though they arise from micro-level interactions (Stacey 1995). As Mitleton-Kelly (2003) explains, such properties are "greater than the sum of the parts and may be difficult to predict by studying…individual elements" (19). In complexity theories, the emphasis is often on the interacting whole rather than the distinct elements, but there are reciprocal influences and feedback relationships between elements, subsystems and the whole. As a result, the macroscopic structures that emerge from microscopic events lead to a modification of microscopic mechanisms (Prigogine & Stengers 1989)—they are bound together in an iterative, co-evolutionary relationship.

Researchers have taken up these concepts in the study of human organizations. Part of their focus has been on how complex organizations should be managed if they are understood to have self-organizing and emergent characteristics. Haynes (2007) observes, for instance, that "much of the life of an organization and its ability to relate to the outside world come from the constant interaction of [its] members…[this]…interaction is a *dynamic* and *living process*; it can only be partly controlled by formal and informal sanctions" (41 italics in original). Taking a similar point of view, Stacey (1995) advocates an approach that embraces a dynamic mix of formal management systems (i.e., hierarchy,

bureaucracy, control) and informal, self-organizing systems in order to create responsive and innovative organizations. Klijn (2008) takes these ideas further in claiming that top-down steering may not be required because the macrostructure of complex organizations relate to their micro-structure without active direction. While Morgan (2005) observes that, in complexity, top-down hierarchies give way to emergent hierarchies driven from multiple points within the organization and "generated by the need to cluster and direct activities to address the contingencies at hand" (267).

Organizational learning represents another key area of interest that draws on the concepts of self-organization and emergence (Morgan 2005; Stacey 2001). Mitleton-Kelly (2003) observes, for example, that "emergence in a human system tends to create irreversible structures or ideas, relationships and organizational forms, which become part of the history of individuals and institutions and in turn affect the evolution of those entities" (21). She views organizational learning as a prime example of this. New knowledge and innovations that work teams generate can be construed as emergent properties, which form part of history of the individuals, the team and, at some level, the organization. As more knowledge is generated through self-organized interaction and more collective forms of learning, new patterns of thought emerge at the organizational level, affecting behaviours and helping the organization to adapt and evolve (Mitleton-Kelly 2003).

Mitleton-Kelly (2003) notes that the socio-cultural and technical conditions must be in place for managers to reap some of the potential rewards of self-organization and emergence. She cites, as an example, how organizational learning can be blocked by "complicated authorization procedures" (Mitleton-Kelly 2003: 21) that restrict connectivity, networking, collaboration and the sharing of information and other resources.

Taking this line of thinking further, Morgan (2005) observes that, from a complexity point of view, "the fundamental role of managers is to shape and create 'contexts' in which appropriate forms of self-organization can occur" (267). This may involve nurturing "key elements of the emerging context by opening the old system to new information, new experiences, new modes of service delivery, new criteria for assessing quality" (Morgan 2005: 269). But it is important to note that managers cannot 'control' for specific outcomes. Their job is to create the conditions under which a desired new context can emerge, in part, through collective learning. But it is also to manage boundaries, for example, by shielding a radical experiment in its early stages from the forces of

the 'status quo' and then driving through those boundaries in a very visible way if the experiment succeeds (Morgan 2005: 273).

The implications of self-organization and emergence for strategy formulation and implementation in the midst of complexity are another area of interest for researchers in the organizational and management fields (see Bovaird 2008; Haynes 2002; Stacey 1995). They have led to an emphasis on the broad, inclusive engagement of 'stakeholders' in processes of co-creation and co-production in order to foster responsive, adaptive and sustainable strategies in the face of uncertain, complex endeavours and issues.

4.4 FEEDBACK PROCESSES AND MUTUAL CAUSALITY

Feedback processes and *mutual causality* represent other important features of complex systems. Together, these ideas can help to clarify why systems look the way they do and how they sustain their form, or are transformed, over time (Morgan 2005). 'Positive' feedback processes are mutually reinforcing and account for escalating patterns of change in complex systems (Stacey 1996). Through positive feedback relations, more leads to more and less leads to less. For example, increased consumer demand leads to higher prices and vice versa. 'Negative' feedback processes are mutually balancing and serve to maintain stability (Mitleton-Kelly 2003; Stacey 2006)—through them, changes in one direction are associated with changes in the opposite direction. For example, decreased prices lead to increased consumer demand.

But these simple examples of economic feedback processes are linear and mechanical. They fail to account for the plethora of factors that determine consumer demand (e.g., employment levels, credit conditions, interest rates) and prices (e.g., money supply growth, overall price inflation, international commodity prices) (Morgan 2005). In complex systems, there are many variables and feedback loops, both positive and negative; relationships are circular and dynamic. Contingent factors, such as the degree of connectivity or level interaction between various actors and systems, determine the strength of feedback (Mitleton-Kelly 2003). As a result, managers likely need to "think about change in terms of loops rather than lines and replace the idea of mechanical causality, for example, that A causes B, with the idea of mutual causality, which suggests that A and B may be co-defined as a consequence of belonging to the same system of circular relations" (Morgan 2005: 274).

In thinking about or attempting to "manage" change in non-linear systems, it is important to try to understand the main elements (variables, actors) of the system and the nature of feedback relations between them. But it is equally important to try to have a general view of the system (Ho 2008). Systems that have a large proportion of positive feedback processes in them can quickly and unpredictably flip into qualitatively different states. Even small, positive inputs can yield startling effects, for better or worse (Mitleton-Kelly 2003: 16). As an example, Morgan (2005) cites how seemingly minor errors and oversights incrementally led—through positive feedback—to mutually determine the *Challenger* space shuttle disaster. In addition, feedback loops that once worked may lose their efficacy over time. In a turbulent environment, past experience may not always provide solutions. New patterns of behaviour and new structures may need to emerge which rely on a different configuration of feedback relations (Mitleton-Kelly 2003).

In dynamic, complex contexts, management approaches that attend only to micro-level interactions are seen to be incomplete at best and hazardous or even deadly at worst. But, trying to understand the entire system of feedback and mutual causality in such contexts can be overwhelming and even futile (Morgan 2005). At least two management responses have been proposed to deal with this micro-macro problem.

One approach is for managers to embrace the discipline of "systems thinking" (Senge 1990). Using system 'archetypes' (reoccurring structures of positive and negative feedback relations in complex systems) as analytical tools, managers can simplify the process of understanding system dynamics. For example, the 'tragedy of the commons' archetype can elucidate how and why natural resources often get depleted to the detriment of whole ecosystems as individuals and organizations plunder long term benefits for short term gains (Senge et al. 2008).

Another approach is for managers to use pilot projects and experiments as a means of "probing" the system to gain insights on the feedback loops that sustain a dominant patterns of behaviour and what can be done to help a new, desired pattern to emerge (Morgan 2005: 273). Sometimes these experiments can result in small feedback changes that catalyze a major systemic change—for example, when a successful pilot project proves to provide the crucial positive loop that transforms the context of opinion among key power holders in the organization (Morgan 2005). Other times, they can become part of a critical

mass of other smaller changes that, together, eventually produce a cascading feedback effect across the organization.

4.5 EXPLORATION-OF-THE-SPACE-OF-POSSIBILITIES

Drawing on complexity science, organizational theorists have observed that "the search for a single 'optimum' strategy may neither be possible nor desirable" (Mitleton-Kelly 2003: 14). This observation is based on the notion of *exploration-of-the-space-of-possibilities*, which refers to an adaptive process by which change occurs in complex systems. The organizational and management sciences have picked up this notion to encourage administrators to engage in a continual scanning process in search of new and effective strategies for addressing emergent issues because "unstable environments and rapidly changing markets require flexible approaches based on requisite variety" (Mitleton-Kelly 2003: 14). As a 'meta-strategy', this exploratory stance is seen to reduce the risks associated with the commitment to a particular strategy too early or for too long and in the face of altered circumstances. It emphasizes flexible adaptation and co-evolution within shifting social and economic contexts.

The organizational sciences have taken up these ideas to stress the importance of supporting experimentation and novelty in complex organizations. Some recommended approaches include:

- the meta-strategy of putting in place a series of micro-strategies that are allowed to test and evolve before major resources get committed to any of them (Mitleton-Kelly 2003: 14);
- inventing and exploiting novel uses of existing product or services or parts of the organization (Mitleton-Kelly 2003: 15);
- taking advantage of the "adjacent possible" (Kauffman 2000: 22) by seeing new possibilities one step away from what already exists (Mitleton-Kelly 2003: 15).

Stacey (1995) observes that many, but not all, organizations have as their primary task the generation of novelty in the form new products, processes and services. He claims these organizations must be "internally and spontaneously changeable and innovative" and for this they need to be subject to a nonlinear feedback system that pushes them to operate "in 'chaos', at the edge of

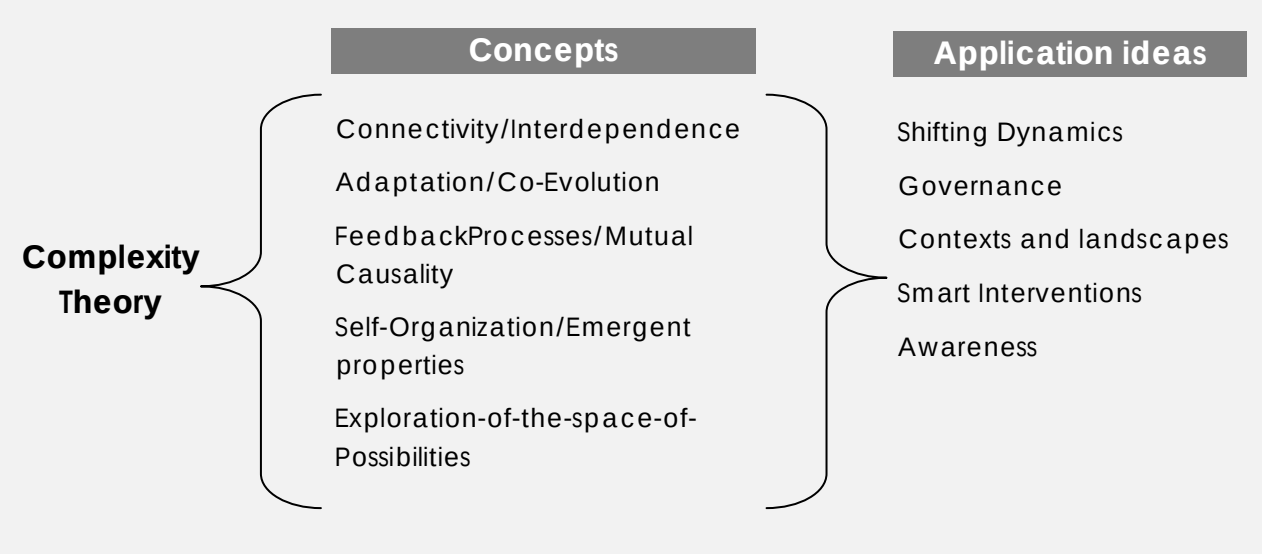
stability" (Stacey 1995: 486). What he has in mind, however, is not the complete randomness and fragmentation that stems from a malfunctioning organization operating in complete instability. Instead, Stacey envisages an organization in "bounded instability" that has a well-functioning formal system (integrated hierarchy and bureaucracy with negative feedback control systems) along with an informal system (high cultural diversity, conflict, political activity, dialogue, ambiguity, weakly shared vision, learning) that continually subverts and changes the formal organization.

The specific long term outcomes from organizations that operate in bounded instability are largely "unknowable" and they may arrive at inappropriate ones and fall upon hard times as a result. They may fall into true instability and potentially disintegrate or they might snap back into a well functioning, stable formal system intent on pursuing a stable primary task. But, if their mission is innovation, according to Stacey (1995), their chance of 'survival' is better if they pursue a state of bounded instability.

5. APPLICATION OF COMPLEXITY CONCEPTS IN PUBLIC ADMINISTRATION

In this section, the core concepts discussed in the previous section are considered at the level of potential application in public administration, framed here with the notion of "managing for complexity". Figure 2 lists some of the key ideas and related practices that have been taken up in public administration research, scholarship and practice.

Figure 2: Some areas of application of complexity theory in public administration



The first point of application consists in the call for public administrators to accept complex behaviours and emergent properties as being part of the normal state of affairs in their organizations and societies (Teisman & Klijn 2008). For many, this might initially appear problematic because it suggests that administrators will need to manage the seemingly unmanageable (Klijn 2006). But what it really means is that existing public management approaches could be improved by complementing them with some of the ideas that flow from the complexity sciences, including guidance that flows from the organizational and management sciences.

5.1 SHIFTING DYNAMICS

Teisman and Klijn (2008) observe that the first broadly accepted insight from complexity theories is that "phenomena are more *dynamic* than most of the traditional scientific approaches assumed" (288) and that this is true for many aspects of governance and public administration. They describe how some dynamics in public administration are linear, in that they are guided by a single dominant force or powerful causal relation, but that many are non-linear and thus inherently unpredictable and unstable. Positive and negative feedback mechanisms can create "temporarily stable situations...however, these can be suddenly disrupted" (Klijn 2008: 304). Decisions appear as punctuated moments of equilibrium, but their implementation leads in unforeseen directions (Teisman 2008).

As a result, public administrators need to complement traditional approaches with an adaptive stance towards *shifting dynamics* (Haynes 2003).[4] Researchers and scholars in public administration have provided some suggestions for a moving forward based on this acceptance of shifting dynamics. Some examples are listed below.

- Managing within complex human environments requires practical, contingent and inclusive approaches (Maguire and McKelvey 1999: 47). This is seen to increase the chances that actions will have a desired effect not due to an objective sense of them being correct or "perfect", but rather because the actions are deemed legitimate and appropriate by the group in question. Such approaches are preferred because they help to provide a general, collective sense of direction, shape the context in which action needs to takes place, and allow for monitoring and course correction (Dent 1999).

- Customary strategic planning processes with clearly stated intentions for achieving specific outcomes need to be complemented with strategic management approaches that aim to "make the most of perceived changes in [the] environment and also to change the longer-term 'rules of the game' which shape how its environment evolves" (Bovaird 2008: 324). Planners and strategists are thus encouraged to relinquish some of their "superman powers" and to

[4] Researchers in public administration can support practitioners by asking questions and conducting studies in ways that capture and describe processes, relationships, interactions, patterns, evolutions and "storylines" that change over time and place (Teisman and Klijn 2008: 288).

swim “in the flow of events along with other actors” (Bovaird 2008: 324), in order to make tactical changes and learn from experiences with others—in other words, to pursue an adaptive approach (Teisman 2008). In doing so, the focus, though oriented to the short-term, will shift to understanding evolving conditions, anticipating risks (Leong 2008) and pragmatically pursuing opportunities (Dent 1999; Haynes 2003).

- Self-organization is an essential component of managing in dynamic contexts. Teisman (2008) observes it is “as important as guidance by politicians and governments” (344) in terms of understanding how governance, policy implementation and service delivery processes unfold. He argues, “This does not mean that management becomes irrelevant. Management is crucial, but now as a self-organizing activity…[it]…is more about what is actually done and less about great initial expectations and steering ambitions” (Teisman 2008: 346).
- Top-down management strategies may not always be effective or appropriate (Bovaird 2008). A more suitable approach may be to focus on connecting the relevant actors and establish patterns of interactions which can lead in desired directions or towards desired outcomes. Here, the manager embraces the complexity of the system and becomes an entrepreneurial facilitator who listens, observes, scans, and connects actors, problems and solutions at opportune times rather than controls and commands (Klijn 2008).
- Local pilot projects offer fruitful avenues for encouraging change in public policy and service delivery. They allow room for responsible experimentation, and can help with overall steering particularly when “top-down prescription is…inappropriate or even unworkable” (Bovaird 2008: 326).

5.2 GOVERNANCE

An increasingly cited way of managing for complexity is to adopt governance processes that provides for adaptation and evolution (see Duit and Galaz 2008; Rhodes 2008; Teisman 2008; Teisman & Klijn 2008). Many of public sector reforms since the 1980s have, in one way or another, sought to do this. They aimed to reshape the roles and relationships of the public sector vis a vis actors in other spheres. Governance approaches generally entail networked, horizontal—or at

times, messy—forms of coordination, which are seen to provide some key benefits to governments and their host societies:

- government is seen to be better positioned to engage the support of, and to collaborate with, the wide range of actors who have a stake in public issues (Dent 1999);
- other actors provide knowledge to help improve scanning, decision-making, and public policies and services (Dent 1999);
- improved levels of inter-organizational or inter-jurisdictional coordination mean that uncertain developments and risk in the public sphere can be managed better by (Wagenaar 2007).
- Learning, innovation and managing "knowledge assets" are fostered (Leong 2005); and
- legitimacy of decisions is enhanced as governance reforms are linked to improving the relationship between the public sector and the public (Klijn 2006);

Governance approaches can be contrasted with the more measurement-centric or positivistic approaches to management. As Klijn (2006) states, "in the new public management the manager tries to keep as far as possible from the complex interaction system itself" (11). Performance based approaches are seen as struggling with complexity at every turn, consistently attempting to reduce the complex nature of the organizational environment into manageable and comprehensible figures (Haynes 2003). The complex systems of government agencies are treated as 'black boxes', wherein outputs are measured, but systemic operating structures are deemed too complex to be properly understood and managed (Klijn 2006). Meanwhile, "the governance perspective tries to address complexity by stepping into the complex system and designing governing mechanisms and strategies that are specifically targeted at the situation and characteristics of the process" (Klijn 2006: 12).

Not surprisingly, many questions have arisen regarding the role of government within the emerging governance approaches in public administration. Of particular importance here is whether and how such approaches will allow for the necessary levels of adaptation and evolution that a complex world demands, while creating the order, coherence and stability that many citizens and public administrators crave. In this regard, complexity theories suggest government should be able to put more stock in the capacity for actors to be

self-organizing once they are connected (Teisman 2008). Here, networks can be more important than grand organizational designs or overbearing management systems. Traditional, top-down, control-oriented management may be rolled-back (although not abandoned in order that some boundaries be maintained), in order to create the space within which new relationships, new ways of working, new structures and, with them, new order and coherence emerge.

5.3 SMART INTERVENTIONS

Another contribution of complexity theory to public administration could be that of *smart interventions*. Because complex systems are often unpredictable and frequently display emergent properties, the more specific knowledge a public manager has of a situation and the system in which it is occurring, the better off he or she will be (Klijn & Teisman 2006). Interventions that managers make should be aimed at establishing connections, relationships and flows between actors that "realize interaction patterns and-or outcomes that are going in the desired direction" (Klijn & Teisman 2006: 12). While they cannot predict or control for the longer term outcomes of their intervention, the work of managers is to (incrementally) shape the context and thereby influence the development of events towards a broadly conceived goal.

5.4 CONTEXTS AND LANDSCAPES

While a complexity lens reveals many of the processes in public administration to be dynamic and non-linear, it also foregrounds how the context, or landscape, of public administration is unstable and constantly shifting. Public officials and other actors and entities continually negotiate and shape this landscape on their governance journeys. Teisman (2008) explains:

Evolution is assumed to be a survival journey in a landscape in which only the fittest survive…Organizations and managers…appear, reappear and disappear from the stage of implementation…those who survive…are often seen as the fittest. The fittest party does not have to be the most powerful party. In an evolutionary approach being the fittest is a combination of being powerful and strong and being able to adjust to changing landscapes. (344)

Pascale (1999) and Klijn and Teisman (2006) view managers as riding 'fitness landscapes'. While interactions within complex governance systems are mutually influencing, such that choices and events continually reshape the

positions of actors, the notion of fitness landscape implies that some choices, events and positions are more likely than others. In this scenario, managers are encouraged "to be aware of the opportunities in that landscape and use them

to realize interesting policy proposals or to change proposals and actor coalitions in such a way that they fit the landscape" (Klijn & Teisman 2006: 12).[5] As with making smart interventions, to ride the fitness landscape successfully managers must maintain an acute *awareness* of the terrain of the overall system so they are able to take advantage of emerging situations.

6. CONCLUDING THOUGHTS

Operating complex organizations within a complex environment presents new challenges to public administrators. Potential responses have appeared in practical innovations designed to complement and potentially alter conventional practices. These innovations include new governance arrangements, networked forms of organization, adaptive strategy and planning processes, piloting and experimentation, systems thinking, organizational and contextual awareness, and inclusive management practices.

Klijn (2008) observes that "a well-developed conceptual model on [public] management based on complexity theory is absent" (313). Figure 3 presents some of basic insights on the direction such a model might take.

Figure 3: Classical management complemented with complexity ideas

Classical management	Managing for complexity
Planning	Scanning, anticipating
Organizing	Shaping context, connecting
Directing	Influencing, promoting self-organization
Controlling	Monitoring, adapting

[5] This management idea is somewhat similar to Kingdon's (1984) notion of the policy entrepreneur in who tries to make connections between streams of problem solutions and choice opportunities, or uses these streams to promote policy proposals.

Some lessons we learned from this literature scan are listed below.

- If we view public sector organizations and public administration as complex sub-systems operating in complex contexts and we can understand some of the main features of such systems (i.e., they are dynamic, non-linear, self-organizing, emergent), we should consider working with those characteristics rather than blocking them. This would likely produce novel theories and practices. It would allow us to see public administration as an expansive space of emergent possibilities.

- Management approaches stemming from complexity ideas may offer promise in addressing 'wicked problems' or 'wild cards' (Klijn 2008; Ho 2008), but they are not suitable in all contexts and should be viewed as a complementary to existing management approaches. This raises the question of how practitioners can know (or at least sense) they are working in complex versus 'merely' complicated conditions.[6]

- The main features of complex systems are interrelated (i.e., connectivity related to feedback relates to self-organization relates to emergence). To gain maximum conceptual and practical benefit from them we need to understand these interrelationships better. The language that describes these features can be fairly abstract, even when applied to empirical cases (see Bovaird 2008; Rhodes 2008; Teisman 2008). It has proven to be challenge for organizational theorists and public administration scholars to reinterpret these concepts and their interrelationships in ways that are immediately accessible to busy practitioners.

- More work is needed to describe the enabling infrastructures, both socio-cultural (i.e., competencies) and technical (i.e., systems modeling techniques), that are required to support connectivity, interdependence, self-organization and emergence in ways that will help practitioners to tilt the system towards the co-evolution of public goods and to avoid the potential for producing undesirable outcomes and system states.

[6] Westley, Zimmerman & Patton (2006) offer a helpful typology that describes features of simple, complicated and complex problems.

- There are uncertainties and risks in putting complexity ideas into practice in governance and public administration. The literature reveals, for example, that connectivity cannot be increased indefinitely without increasing the likelihood of breakdown (Mitleton-Kelly 2003). Emergence is not always efficacious—it can also be maladaptive. Pushing organizations into far-from-equilibrium states can destroy their efficacy and lead to their disintegration.

- Questions arise regarding the implications of complexity approaches in public administration for conceptions of 'good government'. How are accountability, due process and even rule of law to be understood and practiced under conditions of self-organization and emergence *formally sanctioned by government*?[7]

- Questions also arise as to the compliance and performance management approaches that governments will need to use to promote feedback, self-organization, co-evolution, and emergence. How will control systems and performance measurement in government need to change in order to support foresight, learning, innovation, adaptation and agility?

- Complexity theories, and in particular those associated with complex adaptive systems, likely have many insights to offer regarding resilience, although these insights were not readily picked up in this literature scan. Ideas about surprise, co-evolution, adaptation, innovation, emergence and novelty will need to be investigated further. It is our emerging hypothesis that managing for complexity will bolster resilience.

Finally, part of the impetus behind this literature scan was to see if and how complexity theories might provide insights as to how governments can become better at reading the future, spotting emerging trends, and proactively intervening. What we found were insights on how to better read complexity and assume adaptive stances within it, thereby helping to shape it. These insights pertain mainly to short-term horizons. The case studies we found provide a useful 'time series' or 'historical' look at complex governance processes. But they do not provide insight as to how to read the past for what the future may hold, even if only probabilistically. We are not disappointed by these findings, but they

[7] Leong (2005) makes similar observations.

do raise questions for us about where to look next for guidance and whether and how governments will be able to gain more distant and reliable vision into the future. The work that Singapore is doing in this regard with its Risk Assessment and Horizon Scanning system will be of significant interest to the "new synthesis" research network.

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LITERATURE SCAN #3:

Resilience: Key Concepts and Themes and Their Implications for Public Administration

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Project Leader's Team

September 2009

SUMMARY

Resilience is the capacity of social systems to deal with risk and vulnerability and to bounce back from shocks. It represents a relatively new field of research and practice that is being applied to understand the adaptive capacities of individuals, organizations, communities and societies in the face of uncertainty and surprise.

This paper explores key themes from the resilience literature, with a view to deriving potential implications and principles for public administrators in the 21st century.

Some of the implications include:

- Change is an inevitable and healthy part of social and organizational life. The need for abrupt change often arrives when organizational life appears to be most stable, functional, high performing and under control. Failing to embrace some degree of change can lead to 'rigidity traps' that serve to decrease adaptive capacity and increase vulnerability in the face of surprises.
- A twin focus on anticipating developments and building adaptive capacity is needed. The former supports foresight, planning and preparation. The latter allows for greater agility in seizing opportunities or bouncing back from surprises.
- Investing in identifying and mitigating vulnerabilities is important; however, the focus should not solely be on avoiding loss at the expense of learning to adapt to uncertainties. Adaptability cannot be bought or commanded when needed. It must be nurtured on an ongoing basis.
- The work of building adaptive capacity needs to emphasize exploration, experimentation, learning and innovation, including the ability to scale-up and exploit innovations.
- The goal for public organizations is a balanced portfolio of strategies. This portfolio may focus on avoiding negative events in the first place; creating early warning systems; reducing threats and vulnerabilities; finding ways to "put the brakes on" negative developments as they

occur; planning short-term responses to keep the situation from spiraling out of control; and building capabilities for renewal over the long haul.

- Fostering resilience may come with a cost-benefit calculation that involves a trade off between short term high performance and a longer term gain in adaptive capacity.
- Some resilience strategies may be designed for "dual-use", such that investments in them enhance resilience while simultaneously providing additional, more immediate benefits.
- Cross-level (e.g., levels of government) and cross-scale (e.g., time and space) analysis of complex public issues is required to keep institutional, governance and policy responses appropriately matched to modern challenges. Overlapping institutions, though they may seem inefficient, are perhaps better suited to perform relative to these types of issues.

In essence, resilience requires a dynamic, shifting and evolving character in public organizations that may contradict some traditional hierarchical models and assumptions. A balanced portfolio of strategies seems to be the order of the day.

The formative principles derived from the literature point to the need for foresight and anticipation; redundancy; diversity; attention to cross-scale interactions; flexibility and adaptability; experimentation and innovation; collaboration; transparency; co-management and shared governance.

1. INTRODUCTION

The complexity of social systems is such that our capacity to fully understand and predict future developments in them will never be complete (Berkes 2007). Recognizing this, scholars in diverse fields such as ecology (Holling and Gunderson 2002; Gunderson 2009), psychology (Masten et al., 2008), disaster management, emergency preparedness and security (Allenby and Fink 2005; Paton and Johnston 2001; Goldschalk 2008) are examining ways of decreasing the level of uncertainty and vulnerability in complex systems. They are also exploring approaches to coping with change, shocks and surprises (Berkes 2007).

A focus on resilience—that is, the capacity of social systems to deal with risk and vulnerability and to bounce back from shocks—represents a relatively new field of research and practice that is being applied to understand the adaptive capacities of individuals, human communities and larger societies faced with uncertainty in the context of complexity.

This paper discusses the key findings of an initial literature scan of primary and secondary sources related to resilience thinking. The purpose of the scan is to highlight key concepts and themes that can further our understanding of resilience thinking within the context of public administration and the "New Synthesis" research program.[8] The paper focuses on the following:

- discussion of key concepts related to resilience;
- identification and discussion of key factors relevant to building resilience; and
- implications for public administration.

[8] For more about this research program, see http://www.ns6newsynthesis.com.

2. DEFINITION

Resilience is defined in various ways depending both on the discipline within which it is being studied and on the scale of analysis. A brief sampling of resilience definitions from the ecological, social, city, community, organizational and individual levels of analysis are included below.

- Ecological system resilience has been described in two basic ways. The first emphasizes the capacity of a system to absorb disturbance and reorganize, while continuing to undergo change and to retain essentially the same function, structure, identity, and feedbacks (Walker et al. 2004). The second focuses on the amount of disturbance a system can endure before it reaches a threshold and flips to a very different state of affairs behaviour (Holling and Gunderson 2002: 22; Scheffer and Carpenter 2003).

- According to Adger (2000), social resilience is "the ability of communities to withstand external shocks to their social infrastructure" (361). As such, external shocks from the environment as well as from social, economic and political spheres are all important considerations (ibid.). Allenby and Fink (2005) define social resilience as "the capability of a system to maintain its functions and structures in the face of internal and external change and to degrade gracefully when it must" (1034).

- In examining urban hazard mitigation, Godschalk (2003) defines a resilient city as "a sustainable network of physical systems (i.e. infrastructure, communications, natural systems) and human communities (i.e. social and institutional components)" capable of managing a major shock without long-term physical, social or economic damage (137).

- According to Norris et al., community resilience is "a process linking a set of networked adaptive capacities to a positive trajectory of functioning and adaptation after an initial disturbance" (2008:131). Similarly, Paton and Johnston (2001) describe resilience as the capacity of a community to bounce back and utilize physical and economic resources effectively after exposure to a hazard.

- In describing organizational resilience, McManus et al. (2007) observe that resilience is a function of an organisation's situational awareness, management of keystone vulnerabilities and adaptive capacity in a complex, dynamic and interconnected environment.

Finally, individual resilience emphasizes the process of successful adaptation in challenging or threatening circumstances (Masten et al., 2008).

These definitions suggest there are two ways of thinking about resilience: i) as the capacity to adapt when faced with disturbance, stress or adversity and ii) as the capacity to snap back to a state that existed before the disturbance or stress. Some researchers observe that when considering human communities, organizations, and societies, adaptability rather than persistence to some pre-existing state is of greater importance (Norris et al., 2008); the focus should be on the flexibility of the human system when facing change (Berkes and Turner 2006). Walker et al. (2006), however, provide a useful description that brings together the two ways of seeing resilience. They claim it is the capacity of a system to absorb disturbances, undergo a change process, and still retain more-or-less the same functions, structures and feedbacks.

Resilience can be viewed as both a dynamic process and an outcome of particular strategies and means (Cascio 2009). Some authors argue that the process point of view is more important and useful in relation to human systems because it emphasizes the need for continual monitoring, experimentation, innovation, and adaptation since change and surprise are facts of life (Norris et al., 2008).

3. RESILIENCE - KEY CONCEPTS

The In this section the concepts related to resilience are outlined to provide a broader understanding of why resilience is important and how it can be fostered within social systems. These concepts include: panarchy, adaptive capacity, anticipation, vulnerability and trust.

3.1 PANARCHY

Developed in the field of ecology, Panarchy is a theoretical model that aims to explain the evolving nature and dynamics of complex adaptive systems,

including whether and how they are resilient (Holling 2001). This model holds promise for application in public administration as it has already been used in environmental and natural resource management, and sustainable development (Walker et al., 2006).[9]

3.1.1 HIERARCHY

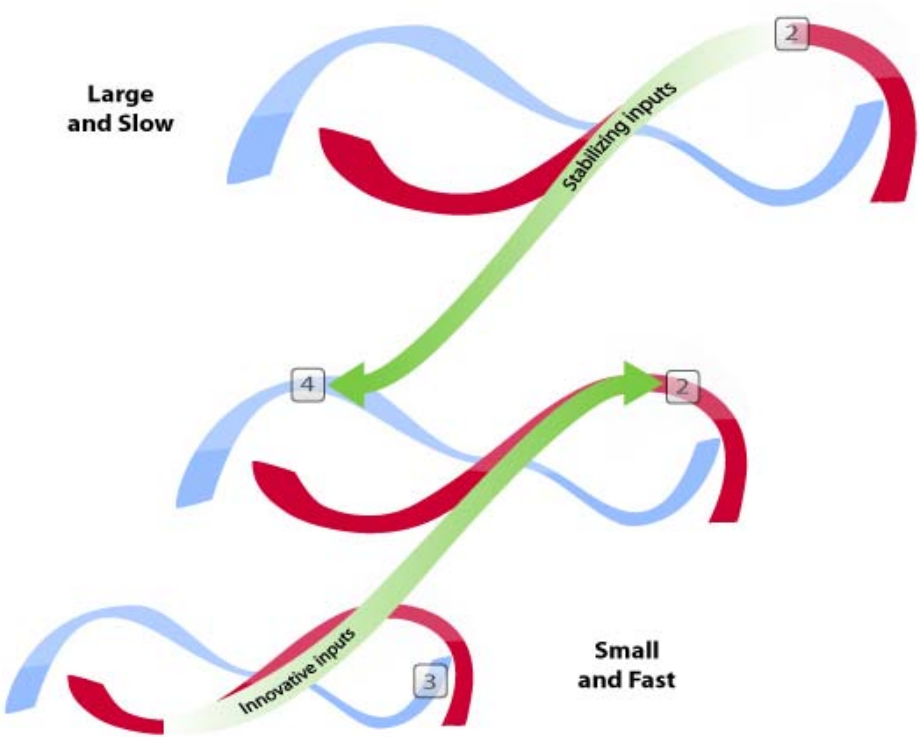
The Panarchy model describes how complex adaptive systems consist of hierarchies that evolve through dynamic interactions within and between hierarchical levels and across different hierarchies (Gunderson & Holling 2002; Gunderson 2009).[10] Importantly, hierarchy in this model does not consist of the top-down structure of "authoritative control" (Holling 2001: 392) that is familiar to the field of public administration. Rather, it is conceived as having semi-autonomous levels formed through the interactions of actors (or variables) which share similar scalar attributes (e.g., cycles of production, geographic footprints, population sizes). Each level contributes "a small set of information or quantity of material to the next higher level" (Holling 2001: 392). As long as this transfer is maintained, changes, adaptations and transformations can occur within levels without disrupting or threatening the integrity of the whole system. As a result, there is "wide latitude for experimentation within levels" which increases the "speed of evolution" in the system (Holling 2001: 393).

The semi-autonomous levels within each hierarchy are seen to be in never-ending cycles of change (Holling 2001: 392). But, importantly, change generally occurs through faster cycles at lower levels (or smaller scales) and at slower rates at higher levels (or larger scales). In addition, hierarchical levels are interlinked, such that lower levels can provide innovative inputs to higher levels and higher levels often serve to conserve and stabilize conditions for lower levels. Figure 1, adapted from Holling (2001), attempts to capture these ideas.

[9] Panarchy has been adapted to address social systems, ecosystems, and the interactions between the two.

[10] Panarchy is the title and subject of an influential book edited by Lance Gunderson and Crawford "Buzz" Holling (2002) that focuses on transformation and adaptation in human and natural systems. The Panarchy model has given rise to an international research program and network called the "Resilience Alliance" (see http://www.resalliance.org/1.php).

Figure 1: Adaptive Cycles at Different Levels in a Hierarchy



Seeing hierarchies as dynamic elements of a complex adaptive system offers a different organizational and management metaphor for public administration. It suggests, for example, that i) top-down control in public organizations may not always be the appropriate focus, ii) healthy, resilient organizations will have different workgroups at different phases in a learning and performance cycle and iii) *every* level does not need to be tightly connected, synchronized and aligned with the current mission.

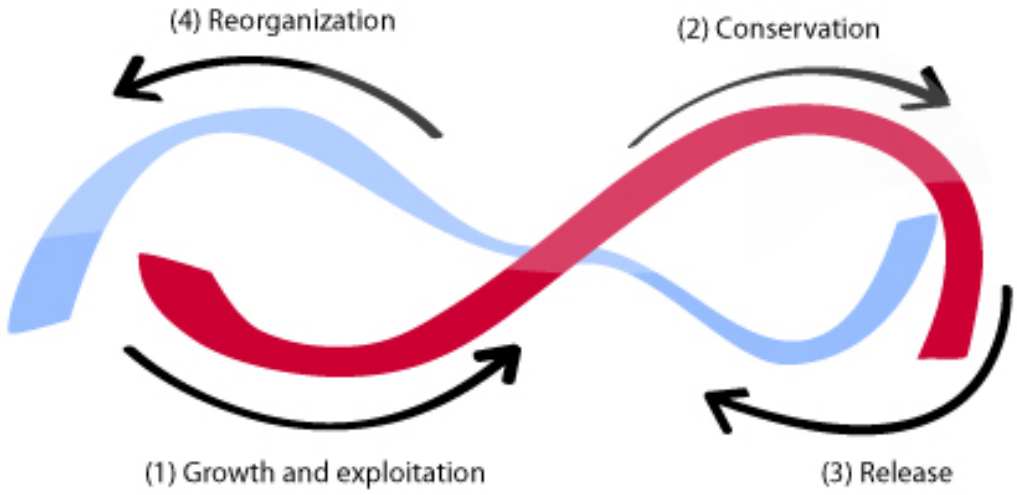
3.1.2 ADAPTIVE CYCLE

The dynamic change process that takes place at each level in the hierarchies that comprise complex systems is known as the "adaptive cycle." This is a metaphor (or heuristic) used to describe four commonly occurring phases of change in complex systems (Holling 1986). The four phases of the cycle include (1) exploitation and growth; (2) conservation; (3) release; and (4) reorganization. Figure 2, adapted from Holling and Gunderson (2002: 34), presents the main features of the adaptive cycle concept.

In essence, the adaptive cycle encompasses the two opposites of growth and stability as well as change and variety (Holling 2001). In this model, the transition

from phases (1) to (2) is a relatively slow, incremental process of growth and accumulation. For example, in a social system, accumulation could include skill development and retention or building mutual trust and networks of relationships (Gunderson & Holling 2002, p. 35). In an organizational setting, it could describe the processes of alignment and continuous improvement that lead, eventually, to high performance. The transitions from (2) to (4) usually begin with some form of internal or external disturbance that creates the need for rapid change and leads, in many cases, to experimentation, learning, innovation and renewal. For example, in an organizational setting, a collapse in demand for products or services could lead to the need for adaptation and renewal.

Figure 2: Adaptive Cycle



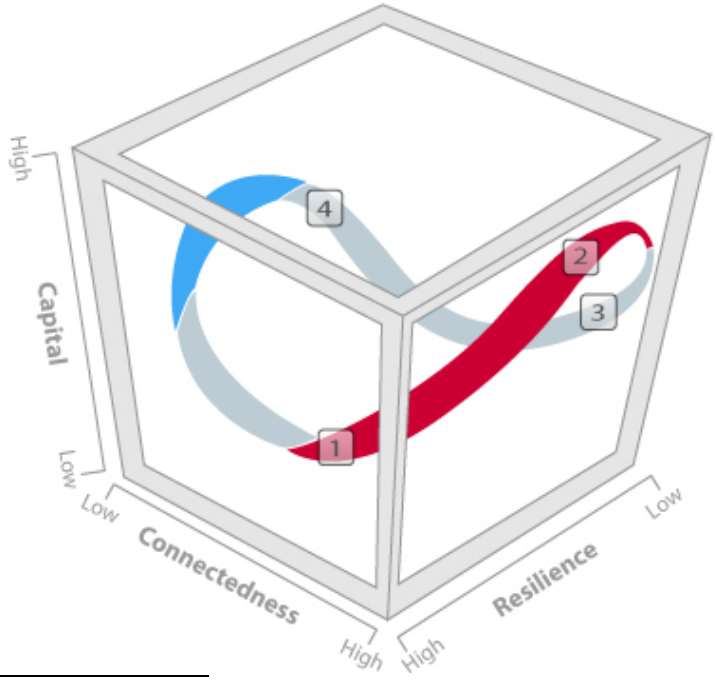
Importantly, resilience is seen to expand and contract throughout the adaptive cycle. This can be better conceptualized when the adaptive cycle is framed within three dimensions, as presented in Figure 3, which is adapted from Holling (2001: 395). These dimensions include:

- the "capital", "potential" or "wealth" in a system that "sets the limits for what is possible—it determines the number of alternative options for the future" (Holling 2001: 394);
- the connectedness of internal processes within a system that "determines the degree to which a system can control its own destiny, as distinct from being caught by the whims of external variability" (Ibid.); and

- the resilience of a system, which is a measure of its adaptive capacity and points to how vulnerable the system is to disturbances (Holling and Gunderson 2002, p. 41).

Resilience is seen to shrink during the growth and accumulation process from (1) to (2) where the system becomes increasingly "brittle" as internal control processes become more connected and aligned (Holling 2001, p. 395). For example, research into social capital shows how sometimes the tight "bonds" that develop within distinct social groups can make those groups less capable of coping productively with external demands and pressures, particularly if they have not built "bridges" with other groups that allow for the tensions and diversity that foster learning (Newman and Dale 2004).[11] In contrast, resilience grows as the cycle moves through the release and reorganization of accumulated resources and the eventual exploitation of those resources in renewed or recombined form (Holling 2001, p. 395). In the social capital example, this would be when dissimilar social groups collaborate to tackle a common problem and, in the process, reinvent themselves and their mutual relationships (and thereby begin to accumulate new forms of social capital).

Figure 3: Resilience in the Adaptive Cycle



[11] "Stove-pipe" or "silo" organizations may be examples that will be familiar to public administrators in this regard. These types of vertically aligned organizations can be very efficient at delivering on a specific mission, but they can become very ineffective when circumstances or the mission changes and they can disrupt the effectiveness of the broader system.

In some cases, however, in the transition from phases (2) to (4) a system can lose its fundamental structures, functions and integrity. This can result in change or "regime shifts" that are maladaptive (Holling 2001). Maladaptive regime shifts can have catastrophic consequences, such as civil war in social systems or structural collapse in an organizational context.

At least two situations can make the adaptive cycle particularly maladaptive, thereby undermining resilience. The first is a "rigidity trap" that develops when the system is so tightly aligned and internally controlled that it cannot adapt (Holling 2001: 400). These types of systems may appear resilient because they can endure external forces and pressures for long periods of time. Some examples include autocratic political regimes such as the Soviet Union (Levin et al. 1998) and large, classical bureaucracies (Holling & Gunderson 2002). But, over time, these systems lose their creative and adaptive capacities as novelty and inventiveness are "smothered" in them (Holling 2001: 400). Without novelty, the system becomes brittle and lacks the creative space needed to adjust to shocks.

Another maladaptive cycle consists in the "poverty trap" (Holling 2001: 400). This is where potential and diversity in the system have been eradicated through misuse or by an external force, so there is little "capital" left in the system to contribute options for its reorganization and renewal (see Holling 2001: 400). Examples here might include countries or organizations that have been subject to autocratic rule and corrupt officials. But they can also include organizations that have been starved for resources and have a large amount of "dead wood" and little "new blood."

The dynamic of resilience in this model might seem paradoxical. It implies that when a social system is operating at high potential it is also highly vulnerable to disturbances and surprises. This paradox is well understood in the business world, where continued reliance on a successful product, production process, business model, or strategy is often seen as a weakness, while investment in agility and innovation is seen as a strength (Morgan 1999). It is also understood—but perhaps less well practiced—in public administration (Borins 2008; Pfeffer 2009), where a strong emphasis is placed on internal controls, ensuring production processes and resources are tightly aligned with immediate priorities, all with a view to increasing accountability, efficiency and improving performance (Bourgon 2008; Gregory 2007). The warnings in the resilience literature about rigidity and poverty traps provide insights as to how public administration may wish to refine its understanding of innovation, control, efficiency, and risk.

The concept of adaptive cycles is not incompatible with, or completely foreign to, public administration. Mergel and Armstrong (2009), for example, map four parts of the emergency management cycle to the four phases of the adaptive cycle in order to demonstrate how resilience can be built in the face of civil conflict and natural disasters:

- "emergency preparedness" should be pursued when times are good in order to deal with conflicts or disasters that may occur;
- "emergency response" activities are needed during the events;
- "recovery" mechanisms need to be in place to reorganize and rebuild; and
- drawing on lessons learned, "prevention & mitigation" activities should be undertaken to stave off or decrease the impacts of future problems (28-29).

Importantly, capacity-building in all four parts of the emergency management cycle needs to be continually pursued so there is no weak link in the cycle.

In a related example, Allenby and Fink (2005) describe how there are a number of opportunities in an "event life cycle" to implement resiliency strategies:

One might invest in avoiding any event in the first place; creating long term plans that reduce or mitigate the threat; generating a warning in time to implement or adjust plans and reduce potential costs; mitigating the event as it occurs; or planning short-term responses...or longer term recovery capabilities. (1034)

In a final example, Janssen (2002: 250) shows how the adaptive cycle is helpful in understanding institutional dynamics—in particular how different groups at different stages of policy development generate new institutional arrangements. The growth and exploitation phase from (1) to (2) of the cycle can be conceived as the policy implementation process. In Janssen's view, this process is dominated by "bureaucrats". The release phase from (2) to (3) of the cycle can be seen to occur when policy implementation is disrupted, sometimes by crisis, during which time "activists" dominate the cycle of change. From phase (3) to (4) the development of options and the process of reorganization are led by "catalysts" and either the existing institution rebounds from the crisis in a renewed form, or entirely new institutional arrangements

emerge (though, it is important to note, there can be no guarantee that any new arrangements will be better or worse than previous ones).

3.1.3 LEVELS AND SCALES

According to Holling (2001), adaptive cycles take place "in nested sets at scales ranging from a leaf to the biosphere over periods from days to geologic epochs, and from the scales of a family to a socio-political region over periods from years to centuries" (392). Building on these ideas, Cash et al., (2006) distinguish between various scales that are important in examining dynamics in complex human and, in this case, ecological systems. These include:

- spatial scales (e.g., patches, landscapes, regions, the globe);
- temporal scales (e.g., daily, seasonal, annual, generational);
- jurisdictional scales (e.g., localities, provincial, national, international)
- institutional scales (e.g., operating rules, laws/regulations constitutions)
- management scales (e.g., tasks, projects, strategies)
- scales of human networks (e.g., family, kin, society, trans-society); and
- scales of knowledge (e.g., practice-based local knowledge, generalized-formal science).

Allenby and Fink (2005) observe that complex challenges will often cut across multiple levels in a scale. Using the example of protecting a city from a biological terrorist attack, they observe that designing individual buildings which can be sealed against pathogens is a useful exercise. It can contribute to some level of resilience. But such buildings "will not substitute for an urban sensor system that enables early and accurate definition of an attack's parameters, nor the emergency response effort the city as a whole will need to mount" (1034). Important interactions are also seen to take place across different scales. Cash et al. (2006), for example, note that decentralization (a spatial scale) can lead to strong interactions and conflict between national and local levels of government (a jurisdictional scale), which may include issues regarding power, responsibility and accountability. Moreover, the direction and strength of these interactions will change over time (a temporal scale).

Some important issues are observed regarding levels, scales and the management of problems in complex systems. The first of these pertains to

failures in governance institutions to recognize the importance of level and scale interactions. This can result, for instance, in "national policies that adversely constrain local policies, local actions that aggregate into large-scale problems, and short-term solutions that aggregate into long-term problems" (Cash et al. 2006).[12]

A second issue pertains to mismatches that regularly exist between the levels and scales of governance institutions and the other levels and scales that also shape the context of complex problems. An archetype in the literature is the "problem of fit" that exists between human institutions that do not map coherently onto other implicated scales (e.g., ecological, geographical, temporal). Such mismatches can result, for example, in poor environmental and resource management outcomes (Cash et al. 2006; Cumming, Cumming & Redman 2006). Another example is mismatches that can take place between the scale of knowledge and the levels at which decisions are made—for instance, climate change models that are not useful to local decision-makers (Kates et al. 2001) or local, traditional fishing knowledge that is not deemed relevant in negotiations on international fisheries treaties (Berkes & Folke 2002).

An issue related to the "problem of fit" is that different actors perceive different scales and levels as being of relevance in addressing problems in complex systems. Cash et al. (2006) observe a "challenge arises out of the incorrect assumption that there is a single, correct, or best characterization of the scale and level challenge that applies to the system as a whole or for all actors." If a single set of levels and scales are selected to frame, understand and address a complex challenge, it can result in ineffective policies and inequitable outcomes (Cash & Moser, 2000). Different actors may experience the effects of cross-scale or cross-level interactions differently, or hope to gain from strengthening or weakening certain linkages (Cash et al. 2006). The risks and benefits resulting from a reconfiguration of these linkages are often asymmetrical (Adger et al. 2005). An example of this is when governments frame problems in ways that allow the problems to become "tractable within their jurisdictions" but which shift the problems and make them less tractable in other jurisdictions (Cash et al. 2006).

The importance of hierarchies, adaptive cycles and scales in understanding resilience is aptly summarized by Holling (2001):

[12] Page numbers for Cash et al. not available as the journal is in online format.

If we can understand these cycles and their scales, it seems possible…to identify the points at which a system is capable of accepting positive change and the points where it is vulnerable. It then becomes possible to use those leverage points to foster resilience and sustainability within a system. (392)

3.2 ADAPTIVE CAPACITY

Adaptive capacity is a central feature of resilience. Carpenter et al., (2008) describe it as the ability of a system to adjust to both internal and external demands. This definition highlights the reactive—or responsive—dimension of adaptive capacity. Within the context of ecological systems, genetic and biological diversity are seen to be sources of adaptive capacity, as they provide options for recombination and evolution in response to changing ecosystem conditions. In contrast, the adaptive capacity of social systems in responding to changing conditions is rooted in learning and creative problem-solving within families, communities, organizations, institutions, networks and so on (Berkes 2007).

Berkes and Folke (1998) and Gallopin (2006) remark that, in human systems, adaptive capacity also has a proactive dimension that allows people to influence change and shape their contexts in addition to responding to changes. Resilience can be intentionally fostered through various strategies and means. Individuals, communities, leaders and institutions in society can foster the necessary social, political, economic, cultural and ecological conditions to take advantage of opportunities and to mitigate the negative impacts of change (Berkes 2007). This proactive dimension of adaptive capacity also involves the ability of people to anticipate and prepare for changes.

3.3 ANTICIPATION

Various strategies have been identified as responses to societal risk. Anticipation is one such strategy (Allenby & Fink 2005). It focuses on the capacity to prevent harm before it occurs (Comfort 1994). According to Wildavsky, anticipation is a "control function that aims to predict and prevent potential dangers before damage is done" (1988:77 cited in Comfort 1994).

Gunderson (2009) notes two important components in an anticipation strategy. The first is predictive capacity (i.e. where and when a disaster might occur); the second is the ability to calculate the potential impact of the disaster. However,

the difficulty of anticipation lies in the complexity of the social or natural systems involved. Often, non-linear behaviours and cross-scale interactions characterize these systems (ibid.). If the probability and specifics of a particular event are difficult to define, enhancing adaptive forms of resilience is an alternative, "rational strategy" to pursue (Allenby & Fink 2005: 1034). It is important, as Comfort (1994) observes, to strike a balance between using anticipation and adaptive resilience strategies in addressing societal risk. She concludes that a capacity for learning from one set of experiences, conditions and actions, and the ability to incorporate this knowledge into the planning and decision-making processes in another context, is crucial to striking a balance between anticipation and adaptation (ibid.).

Anticipation functions are often centrally based in dedicated governmental agencies that collect and analyze information pertaining to security risks or natural disasters, and organize responses to them. However, the thinking about anticipation in the context of resilience is increasingly focusing on the importance of decentralization as a complementary way of collecting and analyzing information and orchestrating responses (Comfort 1994). This approach is seen to have merits because it allows for diverse insights (Habbeger 2009) and fall-back options (Allenby & Fink 2005).

3.4 VULNERABILITY

According to Adger (2006), vulnerability is the state of susceptibility of a social system to harm from perturbations or stresses associated with environmental or social change. In terms of resilience, mechanisms are needed that can help actors to identify and mitigate vulnerabilities. But, susceptibility is also associated with a lack of adaptive capacity, which must also be attended to (ibid.).

Berkes (2007) notes that vulnerability is "registered by exposure to hazards, but it also resides in the resilience of the system experiencing the hazard" (292). Resilience from this perspective is viewed as the "flip side" of vulnerability (ibid.). For example, vulnerabilities of a specific community may be reduced, and resilience enhanced, by creating disincentives to building homes on a floodplain even if there is uncertainty about what the magnitude of future floods might be (Berkes 2007).

Some researchers, however, question the framing of vulnerability as being the "flip-side" of resilience. Fruedi (2008) wonders whether it is appropriate to presuppose the primacy of vulnerability when examining resilience. Doing so, he

claims, can lead policy-makers towards a vulnerability-led response to uncertainty that focuses on avoiding loss rather than building the innovative and adaptive capacities to cope with and prosper in uncertain situations (Fruedi 2008: 651).

Berkes (2007) highlights the role that institutional learning, stemming from responses to previous crises, plays in fostering resilience; while Berkes and Folke (2002) highlight the potential contributions of local, traditional knowledge as a complement to institutional memory and formal scientific knowledge. These various sources of learning and knowledge can help in identifying vulnerabilities and mitigation strategies. Other forms of vulnerability identification include scenario planning, environmental scanning, risk assessment and horizon scanning (Habegger 2009).

3.5 TRUST

Networked organizations and social systems are seen to be more resilient than vertical, tightly aligned and internally controlled ones because they are loosely coupled and dispersed and therefore not subject to collapse from single points of failure (Allenby & Fink 2005). Networked organizations are also seen to allow more autonomy for experimentation and innovation. Public administrators have become more familiar with networks over the last three decades. They have increasingly been engaging public and private actors in order to enhance the knowledge and resources available to deliver public services and to tackle complex issues in innovative ways (ibid.). But networks consist of a complex web of interdependencies between actors, where decisions are made in multiple locations. High interdependence and fragmented decision-making can give rise to high levels of uncertainty (Koppenjan & Klijn 2004). Coordinated action is difficult because inter-organizational networks themselves are ambiguous and unpredictable (Klijn 2007).

Working from the assumption that it is difficult to deal with uncertainties in networks using hierarchical power, direct surveillance or detailed contracts, Klijn (2007) investigates the role trust plays as a coordination and management mechanisms. The importance of building trust in the context of public administration is ever-increasing as governments move towards more horizontal forms of governance (ibid.). Trust makes communication more reliable, thereby making the decisions and actions of actors somewhat more predictable (ibid.). It also enables information exchange, communication, mutual understanding

and innovation (ibid.), all of which are important in times of uncertainty and crisis (Longstaff & Yang 2008).

The levels of trust within and between governments, nongovernmental organizations, the media, citizens and others are highlighted as important considerations in crisis situations (Longstaff & Yang 2008). For example, planners in emergency situations often assume that handing out information brochures or broadcasting government updates will allow individuals to manage during and after a crisis; but if people do not trust the sender or the message it will not be effective (ibid.). Generally, trust can only be established gradually between various actors. It needs to be fostered before crisis situations and sustained during them (ibid.). Mechanisms that help build trust may include proper oversight, transparency and accountability practices and measures (ibid.). For government, it is also important not to be perceived as the source of a particular crisis. Being the source of the problem obviously undermines credibility and trust (ibid.).

Various risks associated with placing too much of an emphasis on trust have been noted in the literature. For example, Klijn (2007) observes that too much trust can lead actors to be overly relaxed with one another, resulting in complacency or a groupthink mentality that can serve to limit options to problems and crises. Longstaff and Yang (2008) observe that some organizations with high levels of trust displayed low levels of preparedness for a crisis, signaling that high levels of trust between organizational members may lead them to have an unwarranted confidence in the ability of their organization to deal with crisis.[13]

[13] Following the Panarchy model, another possible reading of this finding may be that the organizations studied by Longstaff and Yang had fallen into a "rigidity trap".

4. BUILDING RESILIENCE - KEY THEMES

4.1 ROLE OF DIVERSITY

Diversity is seen to be a key contributor to resilience. It can provide a wide range of insights for anticipating events and for identifying and mitigating vulnerabilities. It can supply a breadth of options for dealing with shocks and stresses (Berkes 2007). And it can allow for overlaps and redundancies which reduce the risk of failure (Gunderson 2009; Baker and Refsgaard 2007; Godschalk 2003). A diversity of institutions, both formal and informal, and a diversity of knowledge, including accumulated scientific, local and traditional knowledge, are seen to be of particular importance.

4.1.1 DIVERSITY OF KNOWLEDGE

Combining different types of knowledge and drawing on the complementary nature of various knowledge systems is seen to enhance the capacity to learn, adapt and evolve—thereby supporting resilience (Berkes 2007).[14]

Berkes and Folke (2002) note the strength of conventional science is the ability to collect synchronic data (simultaneously observed, centrally compiled and synthesized), while the strength of local and traditional systems is the diachronic information (long time-series of local observations) they provide. Another asset of local knowledge systems is their willingness to create small-scale disturbances that foster learning and enhance resilience to potential future disturbances (Berkes and Folke 2002). Rather than completely eliminating disturbances, local and traditional knowledge systems tend to accept some disturbances as an intrinsic part of local community life (ibid.).

The difference between formal science and local knowledge systems draws attention to the types of knowledge that may be useful in addressing complex systems problems. Berkes (2007) stresses the need for multi-level information generation and analysis when dealing with complex problems because they can only be understood by looking at them at multiple levels and across

[14] Berkes (2007) cites an example of the Canadian Artic where knowledge sharing between scientists and local residents allowed parties with different knowledge bases and backgrounds to address issues such as organic pollutants and climate change in a comprehensive manner.

multiple time scales. Cash et al., (2006) note the difficulty in matching the levels where useful knowledge is available with the levels where decisions are made. This can affect the salience, credibility and legitimacy of the information as perceived by the actors at different levels (ibid.). However, how to effectively integrate different forms of knowledge is not clearly understood. Cash et al., (2006) cite the potential of "boundary organizations" in playing an intermediary role between different levels and in helping to facilitate the co-production of knowledge, for example, between policy-makers, scientists and local residents.[15]

There are a number of issues related to bringing diverse sources of knowledge together that warrant further attention. An important one is the role power imbalances play in trying to integrate different knowledge systems (Berkes 2007). Others include the differences that exist in perceptions of validity and reliability claims, data collection methods, and whether information is codified or takes the form of oral tradition (i.e. anecdotal reports, storytelling).

4.1.2 DIVERSITY OF INSTITUTIONS

According to Vatn (2005:60 cited in Baker & Refsgaard 2007), institutions are "the conventions, norms and formally sanctioned rules of society…they provide expectations, stability and meaning essential to human existence and coordination [and they] regularize life, support values and produce and protect interests." Institutions can be formal or informal. They exist at various levels from the local to the global, spanning the community, non-governmental, private-sector and public-sector spheres.

The capacity of communities to respond to disasters via their own institutions has been identified as key to effective response and adaptation (Berkes 2007). However, the community level is viewed as a necessary but insufficient source of crisis management (ibid.). Institutions at other levels often need to be involved. In describing resilient cities, Godschalk (2003) notes the importance of private sector and nongovernmental institutions in planning and acting spontaneously alongside central governance institutions in the context of urban hazard mitigation.

Given that many shocks, disturbances and crises can have cascading impacts across multiple levels and scales, and that multiple institutions are often relevant

[15] Cash et al. (2006) observe boundary organizations have some specific functions and characteristics. They are accountable to all sides of the boundary; use knowledge that is co-produced by actors on all sides; convene, translate, coordinate and mediate.

in responding to these events, coordination issues are seen to be significant in fostering resilience. Baker and Refsgaard (2007), for example, examine the importance of cross-scale institutional linkages. They also investigate the need for scale matching in disaster response, noting significant difficulties as the scope and nature of impacts can change rapidly during a crisis. In addition, "what may appear to be an isolated system is actually a sub-system of a larger, evolving adaptive cycle interacting across multiple scales" (Baker and Refsgaard 2007: 333).

In analyzing the case of hurricane Katrina, for example, Baker and Refsgaard (2007) describe coordination issues at various institutional scales. At the municipal level, they observe that the government failed to consider the need for public buses in its evacuation plan. As a result, residents (particularly low-income residents) were not protected from flooding. At the local and state levels, government offices hesitated to evacuate citizens as prescribed by their emergency plans, reducing the time residents had to evacuate. Moreover, the plans did not take into account the fact that many residents would not want to evacuate because, in many cases, their homes and possessions were not insured. At the federal level, the actions of the coast guard were not matched by other federal agencies such as the Federal Emergency Management Agency (FEMA) which had only a small staff in New Orleans prior to the hurricane to pre-position supplies and strategies. In addition, the coordination between FEMA and state and local governments was poor. Importantly, non-governmental agencies tended to respond more quickly. In some cases small non-governmental groups were operating prior to FEMA. In addition, voluntary and non-governmental institutions and the private sector were a key source of financial aid and materials in the first 10 weeks after Katrina.

Handmer and Dovers (1996) argue that although multi-stakeholder involvement is advised in the hazard management field, achieving coordination of multiple actors is difficult and gives rise to uncertainties. They point to hazard management as being a professional activity linked to political and bureaucratic power bases (490), where the focus tends to be on reducing the uncertainty rather than tackling issues of institutional arrangements that help foster adaptability (ibid.). Despite these challenges, aiming for a framework that promotes institutional diversity, flexibility, coordination and rapid response is seen as more likely to promote resilience than centralized and rigid institutions (Baker and Refsgaard 2007).

4.2 MITIGATING VULNERABILITIES

Seville et al. (2006) see organizational resilience as a "function of the overall vulnerability, situation awareness and adaptive capacity of an organization in a complex, dynamic and interdependent system" (3). In constructing a framework for assessing and improving the resilience of organizations, McManus et al. (2007) note the importance of organizational self assessment of vulnerabilities and identification and prioritization of keystone vulnerabilities. Adger (2006) notes the importance of examining a range of risks as well as the various institutional responses and resources as vulnerability is experienced and perhaps perceived differently at various levels. In addition, he notes that when institutions fail to plan for hazards vulnerabilities can be exacerbated.

Adger (2006) acknowledges that vulnerability persists because of unpredictability in complex systems. He also notes, however, that vulnerabilities also persist because of ideological, political, bureaucratic and other limits to perceiving and acknowledging certain risks. This reiterates the importance of diversity, whether in outlooks, values, and organizational forms, in maintaining resilience.

Mitigating vulnerability also requires more thought as to what constitutes vulnerability and how it is experienced by different segments of the population. Adger (2006) notes, for example, that lower-income households tend to live in riskier urban environments, placing them at greater risk from flooding, disease and other chronic stresses. In addition, socio-economic differences affect capacities for accessing and mobilizing resources to mitigate risks, exacerbating vulnerabilities for certain segments of the population.

4.3 ROLE OF SOCIAL CAPITAL

Social capital has been conceptualized in various ways, including seeing it as an individual, community or multi-level asset (see Putnam 2000; Dasgupta 2003; Norris et al., 2008).Various insights from social capital thinking have been used to understand resilience and related concepts.[16] These insights tend to derive from community and institutional perspectives on social capital.

16 The focus of this section is on social capital; however, other forms of capital have been identified as important in resilience thinking. Norris et al., (2008), for example, writes "community resilience depends not only on the volume of economic resources but also their diversity" (137). As economic diversity increases, the likelihood that the community can withstand adversity or surprise also increases (143). Adger (2006) notes that we tend to think of livelihoods as deriving

According to Scheffer et al. (2002), social capital "refers to the aggregate of actual or potential resources that can be mobilized through social relationships and membership in social networks" and it is "built through investing in social relationships" (231). Using this definition, Scheffer et al. (ibid.) highlight how social capital can contribute to adaptive capacity. After a problem emerges, a few stakeholders are involved and a few links may form. As the recognition of a problem increases, affected groups are mobilized and social capital increases as links are formed with other groups. As more people and groups are involved, the potential for conflict may increase as new patterns of reciprocity are tested. This conflict can enhance potential solutions through the possibility of finding integrated solutions. Integrated solutions are seen to be more adaptive than solutions that stem from trade-offs and compromises because they recombine the totality of interests and resources. In confronting problems, if few links are created or few opportunities for reciprocity surface, polarization may result. Polarization represents a less adaptive response.

While the role of social capital at the local, community level in building resilience is recognized within the literature, it is also noted that encouraging strong communities can create silos, along with an "insider-outsider" dynamic, which may serve to limit the willingness of communities to accept assistance from external sources (Norris et al., 2008). In light of this, Newman and Dale (2005) note the twin importance of bonding within communities and bridging links between communities in fostering resilience.[17] Ties within social groups and amongst different groups enhance adaptation to unexpected changes as they provide sources of trust,[18] reciprocity, and options for renewal and help resources to flow.[19]

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from financial capital assets, but they also stem from ecosystem services (natural capital). Thus, when examining risk and resilience, ecological dynamics need to be considered alongside of social and economic ones (ibid.).

[17] This observation is based on Putnam's (2004) distinction between bridging and bonding forms of social capital: "bonding social capital brings together people who are like one another in important aspects (ethnicity, age, gender, social class, and so on), whereas bridging social capital refers to social networks that bring together people who are unlike one another" (11).

[18] The role of trust or lack thereof and how it may foster positive or negative perceptions within community groups, between community groups and between community and formal institutions is important in understanding the links between social capital and resilience (Murphy 2007).

[19] Norris et al. (2008) note there are cultural differences with respect to reciprocity. For example, some cultures are inclined to kinship relationships. Such differences need to be considered when encouraging bonding and bridging aspects of social capital and building resilience.

Adger (2003) notes the literature on social capital tends to focus on non-state actors, failing to capture the role that higher-level, formal institutions play in promoting and facilitating social capital and, with it, resilience. According to Woolcock and Narayan (2000) an institutional view of social capital argues that the vitality of community networks and civil society is largely the product of the political, legal, and institutional environment. Where the communitarian and networks perspectives largely treat social capital as an independent variable giving rise to various outcomes, both good and bad, the institutional view instead views social capital as a dependent variable. This approach argues that the very capacity of social groups to act in their collective interest depends on the quality of the formal institutions under which they reside. (234)

Some important and fundamental institutions, such as rule of law and good government, are required to create the conditions under which trust, reciprocity and social capital can flourish in communities and society.

Adger (2003) promotes this view, envisaging an ideal situation in which a well-functioning state operates with high levels of networking social capital that promotes a synergy between state and civil society. A synergistic approach to social capital focuses on the state-society links and how they interact (Adger 2003; Woolcock and Narayan 2000). For example, an important focus should be on how legal, institutional and governance structures facilitate the community-level networks that are central to resilience (Adger 2003).

The inter-relationships between community groups and formal institutions are relevant to understanding the role of social capital in building resilience. Murphy (2007), for instance, highlights various characteristics that could be further investigated to understand the relationship of social capital and emergency management resiliency in crisis and non-crisis conditions. They include: the congruence (or lack thereof) between municipal and community boundaries and interests; the extent to which community group organization and dynamics is incorporated into local government emergency management planning; and, in the wake of a disaster, organizational and community response, development and change (ibid.: 305).

4.4 EXPERIMENTATION AND LEARNING TO BUILD ADAPTIVE CAPACITY

Having a dynamic learning component in complex systems is essential for rapid innovation when creating responses to disturbances (Berkes 2007; Comfort 1994). Given the range of challenges and the practical impossibility of

predicting and mitigating each one in turn, innovation- and adaptation-led strategies to building resilience are vital (Allenby & Fink 2005).

In terms of learning, Comfort (1994) equates information to "the energy that drives a complex system in its processes of both internal adaptation among its constituent parts and external exchange with the broader environment" (160). Because change can affect various components of a system differently and because the rates of response, learning, performance and adaptation will likely differ in different parts of the system (ibid.), the widespread sharing and integration of information within the system as whole is seen to be a key goal. Sharing and integration of information creates a level playing field, produces greater transparency, fosters understanding across the system, provides a basis for generating options for different actors, and fosters adaptive co-management. How information flows (or doesn't flow) in a system influences its capacity to mitigate future risk (ibid.).

Adaptive co-management of problems in complex systems has been identified as a mechanism that can facilitate innovative learning. This entails a network of actors sharing responsibility and power arrangements as they engage in problem-solving that is feedback-based, iterative and collaborative (Berkes 2007; Cash et al. 2006). This process is seen to test and adapt institutional arrangements and knowledge bases in an ongoing process of "learning by doing" (Berkes 2007).

When implementing policy prescriptions in the face of complexity, adaptation is needed. This requires acknowledging the uncertainty of outcomes and encouraging the participation of various stakeholders. (Folke et al., 2007; Kahane 2004). Errors and risk-taking are seen as integral to the learning process (Berkes 2007). Shocks to the system can trigger periods of experimentation and learning that enhance adaptive capacity and, with it, resilience. It may even be beneficial to deliberately create (or simulate) disturbances, at least at lower levels or at small scales in a system, so that feedbacks can be received and learning can occur before larger scale crisis and disturbances take place (Berkes and Folke 2002).

4.5 GOVERNANCE AND THE CAPACITY TO MANAGE RESILIENCE

Governance is not limited to the state; it is not just various levels of government going about their work. Rather, it is the result of the interactions of many actors, including the private sector and not-for-profit organizations (Lebel 2006).

Governance can be institutionally formalized or take the form of subtle norms of interaction. It can directly or indirectly shape the contexts in which various actors challenge decisions and determine access to resources (Lebel 2006).

Lebel (2006) examined how attributes of governance may enhance the capacity to manage resilience in the face of complex problems. The propositions he explored included:

- participation builds trust, and deliberation leads to the shared understanding needed to mobilize and self-organize;
- polycentric and multilayered institutions improve the fit between knowledge, action, and social-ecological contexts in ways that allow societies to respond more adaptively at appropriate levels; and
- accountable authorities that also pursue just distributions of benefits and involuntary risks enhance the adaptive capacity of vulnerable groups and society as a whole.

In his study, there was some tentative support for all of the three propositions, which may provide a useful focus for further inquiry.

In the context of local sustainability issues, Cuthill (2005) examines the role of local government in supporting and facilitating citizen participation through various capacity building processes. The study finds that engaging citizens and community groups in planning and management of local issues created a self-reinforcing process "that strengthens democratic governance, helps re/build social capital and provides a foundation for citizens and local government to work collaboratively towards a sustainable community" (Cuthill 2005:76).

The capacity for flexibility in governance systems is identified as important for dealing with resilience in complex systems. An example would be multi-level governance systems in which decision making is not focused at the top but is shared by various levels as appropriate. This could include networks, partnerships or polycentric systems (Berkes & Turner 2006). The capacity of such structures to be adaptive would depend on whether institutional arrangements and knowledge sources are tested and revised on an ongoing basis (ibid.). The involvement of a number of levels from local to international as well as the process of learning and testing knowledge iteratively is seen as important for building resilience (ibid.).

5. BUILDING RESILIENCE – INSIGHTS AND PRINCIPLES FOR PUBLIC ADMINISTRATION

A number of insights and principles can be extracted from the concepts and themes in the resilience literature that appear to have utility for public administrators.[20] These can be further explored and examined in the context of the "new synthesis" research project.

5.1 INSIGHTS

Although it may sound like a cliché, the resilience literature makes it clear that change is an inevitable and healthy part of social and organizational life. The phenomena—crises, shocks, disturbances, perturbations—that precipitate abrupt change can arrive either expectedly or unexpectedly; but, in many cases, these phenomena appear when organizational life appears to be most stable, functional, high performing and under control.

A twin focus is needed in building resilience to these phenomena. On the one hand, administrators should try to anticipate, foresee, plan and prepare for what is "coming down the pike". This work should include the assessment and mitigation of vulnerabilities. On the other hand, administrators should concentrate on building adaptive capacities in their organizations and, where warranted, across the broader social system.

Investing in identifying and mitigating vulnerabilities is important. However, the focus should not solely be on avoiding loss at the expense of learning to adapt to uncertainties. The literature tends to caution against vulnerability-led strategies in managing for resilience. Crisis can bring long overdue opportunity for improvement. In striking an appropriate balance of strategies, administrators should emphasize building adaptive capacity. For example, the capacity of a community or industry to respond to shocks via their own institutions fosters adaptation. However, when assistance is warranted, focusing on devising incentives for change, rather than disincentives to change (e.g., subsidies designed to re-establish or maintain the status quo), may better serve to foster long term resilience.

[20] See Walker et al. (2006) for a helpful list of resilience considerations for natural resource managers and Cascio (2009) for a succinct list of generic principles of resilience.

The work of building adaptive capacity needs to emphasize exploration, experimentation, learning and innovation, including the ability to scale-up and exploit innovations. This may require the use of pilot programs, simulations, trials and tests to allow for learning. It may also require a tolerance for mistakes and failure, as long as these are used as sites for learning. In essence, this work places a premium on trial-and-error approaches and "learning-by-doing."

Adaptability cannot be bought or commanded when needed. It must be nurtured on an ongoing basis and is best built using a variety of knowledge forms, including both local and expert forms of knowledge (e.g., front-line employees and citizens, as well as policy analysts and scientists). It relies on relationships and extended networks, in which mutual understanding, trust and leadership are crucial. To secure these assets, investments in building adaptability should be seen as long-term commitments.

The adaptive cycle highlights two opposite phases: one of growth and stability; the other of change and variety. This highlights the need for different capabilities and interventions during different phases of the cycle. Having a robust management system that is capable of attending to all aspects of the adaptive cycle enhances the capacity for resilience within the system. For example, a public administration may need a more robust leadership model that includes fostering bureaucratic, activist, catalytic and entrepreneurial abilities. This array of capabilities would support, for instance, "putting the brakes" on change when there are negative or highly unpredictable potential consequences for the wider system, or exploiting innovations to improve system-wide performance.

With respect to performance, the paradox of high efficiency and its implications for resilience within a system represents an important consideration for public administrators. Aligning, connecting and controlling the structures, functions and resources of a complex organization in a top-down, linear fashion may increase efficiency. Such organizations may be successful for significant periods of time. But, ultimately, administrators may find such organizations in a "rigidity trap" when they are faced with an acute need for rapid response and adaptive change in the face of an unexpected shock or event. Fostering resilience comes with a cost-benefit calculation that involves a trade-off between high performance over a relatively short-term and longer-term gain in adaptability—and, with it, fewer full-blown organizational crises and more organizational sustainability.

The concept of hierarchy in the resilience literature can remind public administrators of the dynamic, shifting and evolving nature of their organizations, and how their organizations are connected to other entities and actors in a complex social system. Working with this new definition of hierarchy, public administrators may be able to help their organizations become more adaptive, less prone to the rigidity trap, and thus more resilient. This new definition allows networks to co-exist with a more traditional, "bureaucratic" order. Different levels in a bureaucracy can accommodate semi-autonomous experimentation and adaptation that will not necessarily threaten to produce conflict and contradiction in the hierarchy, but may in fact produce innovations that provide "fuel" for change at higher levels. Higher levels, in turn, can set the general context and scope for experimentation and adaptation at lower levels, thereby providing a stabilizing force that simultaneously encourages learning and change.

Interestingly, some resilience strategies may be designed for "dual-use", such that investments in them enhance resilience while simultaneously providing additional, more immediate benefits (Allenby & Fink 2005). An example is the creation of corporate intranets, virtual offices and teleworking arrangements that, on the one hand, save organizations money and, on the other hand, protect information assets from "point attacks" and employees from epidemics (ibid.). Dual-use approaches can make investments more palatable from a financial cost-benefit point of view; but it is important to note that "when a resilience option is less coupled to other functions, it can be more easily implemented" (ibid.: 1034).

The importance of considering the range of hierarchical scales and levels that exist in complex adaptive systems, highlights the need for public administrators to understand cross-level and cross-scale interactions in order that their institutional, governance and policy responses are appropriately "matched" to the dynamic mix of cross-scale relationships. It also highlights how administrators need to involve the "appropriate representation of scale related interests" (Cash et al. 2006) in public issues, so the ensuing analysis and solutions will be both effective and equitable. It is also important that administrators learn not to define complex problems only in terms of the levels and scales they themselves understand and value. While doing so may make problems tractable within the levels and scales public administrators know and inhabit, it may exacerbate the problem at other levels or scales. For example, it may push the problem unfairly onto future generations or cause unintended consequences in other jurisdictions. Complex problems that are not addressed with an understanding of

scales and cross-scale interactions can lead to a mismatch that produces thresholds where "regime shifts" occur that are potentially catastrophic (Cumming et al. 2006). Global warming and climate change are poignant contemporary examples of this.

The literature suggests that a diversity of institutions, both formal and informal, and a diversity of governance approaches, with elements of redundancy that bolster resilience are required. This diversity is seen to foster flexible responses to cross-scale issues and to provide a wider array of options for responding to complex problems in a changing world. A singular reliance on top-down decision-making structures may provide short-term efficiencies, but it tends to fail when the circumstances that brought these structures into existence suddenly change. Overlapping institutions and governance structures, while "messy" and seemingly inefficient, are perhaps better suited to perform during times of crisis and change.

Finally, these ideas about complex, adaptive systems highlight for public administrators that, in the governance of human systems, there are many points of connection with strong interactions and feedbacks between them. This complexity needs to be taken into account. Different components of social systems cannot be managed in isolation. Administrative action cannot always be expected to have linear cause and effect outcomes because there are complex, reciprocal relationships between elected officials, the public service, citizens and other actors in policy development and implementation. These relationships take shape in a broader, complex context that extends across time and space. This complexity raises many issues and questions for administrators. For example, how can they learn to read complex systems better in order to be able to anticipate events, shape the context, or connect actors, problems and solutions? Or, how can they find a cost-benefit analysis that can accommodate different time and space scales, so that long-term, wide-reaching, more complex outcomes are not sacrificed for short-term, local, compartmentalized ones?

5.2 KEY PRINCIPLES

Some key principles for fostering resilience can be proposed for public administrators out of this literature. Here are some suggested ones:

- Foresight and anticipation. Some disturbances and shocks are predictable, some are probable, some are possible, and some will come truly from out of the blue. Administrators and their organizations need to develop capacities to read and interpret complex contexts and to anticipate developments.
- Redundancy. Administrators can avoid catastrophes through decentralization, contingency plans, back-ups and overlaps; they can take a long term view by protecting "redundant" capabilities and "venture investing" in new capacities that may be needed in the future; they can consider "dual-use" strategies that simultaneously enhance resilience and provide additional organizational or societal benefits.
- Diversity. Administrators and their organizations can avoid suffering from single points of failure and "blind spots" by not relying on limited sources of information, knowledge bases, points of view, solutions, and governance approaches.
- Scale. To avoid potentially catastrophic failures, administrators need to recognize there are important cross-level and cross-scale interactions in all social systems and should try to understand these better. They should try to match levels in institutional and governance hierarchies to the appropriate levels in other relevant scales (e.g., spatial, temporal). They should embrace a pluralistic, inclusive view on the relevance of levels and scales by engaging the range of actors implicated and affected.
- Flexibility and adaptability. Administrators should not get complacent when things are going well; they should always be prepared to change strategies, plans, governance and organizational arrangements and courses of action.
- Experimentation and innovation. Administrators should make use of pilot projects, simulations and exercises at small scales and local levels

in order to learn, innovate and build capacity; where warranted, they can then scale-up and exploit the innovations at higher levels. Those operating at higher levels provide the space for experimentation at lower levels, establish a context that is conducive for it and set boundaries and limits to ensure stability across the hierarchy.

- Collaboration. Administrators can build shared understanding of risks and vulnerabilities, contingency plans, trust and collective know-how by engaging the full range of actors implicated in and affected by complex issues and domains of uncertainty.
- Transparency. Transparency allows administrators, elected officials, citizens and other actors the ability to decipher where problems may lie; it helps to build the knowledge and trust that is required to respond in difficult situations.
- Co-management and shared governance. Public administrators can heighten adaptive capacity by involving multiple players in a way that embraces co-creation, learning-by-doing, diversity, novelty and change.

6. BUILDING RESILIENCE – CONSIDERATIONS

Planning under conditions of complexity and uncertainty is difficult for decision-makers as so many considerations need to be taken into account (Berkes 2007). Incorporating unknowns into planning or decision-making models is difficult. The resilience literature stresses that decision-makers should expand the number of actors and points of view involved in the process. It also stresses the need for multi-layered governance approaches and network-based forms of organization. Decision-makers may perceive these recommendations as harbingers of increased rather than decreased complexity and uncertainty. They may also be concerned that the specific outcomes of action may become more, rather than less, difficult for them to predict and realize if they follow the resiliency prescriptions.

The importance of nurturing diversity within social systems, such as public organizations, is not as well understood as it is with respect to ecological systems. For example, the benefits of overlapping governance approaches are not well recognized, nor are the benefits of spreading risks across such governance

frameworks (Berkes 2007). In addition, the tendency to centralize decision-making processes is not readily understood as reducing the capacity of other levels within the social system to learn from mistakes (ibid.). Nor is it readily seen as hindering the potential for self-organization (ibid) and adaptation at various levels within the system.

Finally, the characteristics of political systems may influence the potential for various resilience-building strategies to be realized. For example, the willingness of public officials to encourage knowledge sharing, to foster partnerships, and to empower outside actors and communities may be construed as a challenge to the responsibilities and authorities of officials and the conventions within which they operate.

7. CONCLUDING THOUGHTS

Resilience thinking provides some useful insights and potential principles for public administrators about how to approach surprises, shocks, crises, changes and transformations within their complex organizations and societies. Instead of focusing on trying to maintain some perceived optimal state of organizational or social arrangements, a resilience approach promotes the capacities needed to respond to change and to shape desirable alternative states (Walker et al., 2006).

Although it may be possible to foresee and anticipate developments, identify risks, and mitigate vulnerabilities (Adger 2006; Berkes 2007; McManus et al. 2007), this is only one dimension of building resilience. Risk management and vulnerability-led approaches to resilience can detract from the important work of building adaptive capacity. Often, specific events and shocks cannot be foreseen or prevented, which makes an emphasis on adaptation a “rational strategy” for any government concerned about resilience in its organizations, institutions and host society (Allenby & Fink 2005).

Change is inevitable and can be healthy (Berkes & Folke 2002). Attempting to prevent all shocks can create “brittle” organizations, communities, institutions and societies as it undermines the collective capacity to learn and adapt (Comfort 1994; Gunderson, Holling & Light. 1995). Moreover, delaying some kinds of changes can increase the risk of large scale crises later (Holling & Meffe 1996).

The literature suggests that the goal for government is not to attempt to predict or control for all potential shocks. This would be impossible and counterproductive. A balanced portfolio of strategies and means seems to be the order of the day. This portfolio may focus on avoiding negative events in the first place; creating early warning systems; reducing threats and vulnerabilities; finding ways to "put the brakes on" negative developments as they occur; planning short-term responses to keep the situation from spiraling out of control; and building capabilities for renewal over the long haul (Allenby & Fink 2005).

Finally, resilience may not be a global characteristic of a complex system. Very likely it can only meaningfully be determined with reference to an identified aspect of the system and particular challenges (Allenby & Fink 2005). This suggests that the responsibility for building resilience in government needs to stretch across the whole system, and that it needs to feature specific strategies and initiatives for particular policy sectors and challenges.

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LITERATURE SCAN #4:

Collective Intelligence: What is it and how can it be tapped?

Project Leader's Team

September 2009

SUMMARY

Complex public policy issues can emerge at a wide-spanning, systemic level, affecting broad segments of the population. The resolution or ongoing management of such issues requires government and other sectors of society to engage in deliberation and collective action that is equal in its diversity and breadth to the complexity and scale of the issues. One suggested approach is to "tap collective intelligence". The widespread adoption of modern communication technologies has allowed advances in storing, mining and circulating massive amounts of information. This provides a basis for mass collaboration that can assist with the predictive and decision-making functions of society.

This paper explores some ideas and research findings on collective intelligence and how these may be applied to government. It discusses eight forms of collective intelligence as well as the tools for input into decision-making provided by the field, including Web 2.0 technologies, virtual networks, innovation communities and prediction markets.

The paper discusses the building blocks of collective intelligence systems. These include what collective intelligence systems aim to accomplish and what the common processes and structures employed in them are. They also include who performs the tasks in collective intelligence systems and what their motivational bases are for being involved. These building blocks are recombined in different systems to achieve collectively intelligent results.

The paper concludes that further research is required to move the field from conceptual ideas to practical applications in public governance and public administration contexts.

INTRODUCTION

Complex public policy issues can emerge at a wide-spanning, systemic level, affecting broad segments of the population (Douthwaite 2006). Sometimes they arise as surprises, as in Taleb's (2009) "black swans" and "wild cards"; sometimes they can be foreseen; and sometimes they are related to a web of seemingly intractable issues, as in the special case of "wicked problems."

In all cases, the resolution of such issues—or, at minimum, their ongoing management—increasingly is seen to require an ability in government and other sectors of society to engage in deliberation and collective action that is equal in its diversity and breadth to the complexity and scale of the issue (Schuler 2008). This is because

- the likelihood of foreseeing emerging issues is increased when a broader and more diverse audience is looking for them and sharing their observations and interpretations with others;
- complex problems need to be addressed with a *systemic approach* that involves the insights, experiences and interests of all those affected by them (Senge 1990; Wagenaar 2007);
- the *process of co-creating definitions and solutions* to complex problems, no matter how imperfect those definitions and solutions may be, holds great value because it opens up the possibility of concerted action, (Senge 2004); and
- complex problems require *emergent solutions* to be grown through the ongoing interactions between the actors who are implicated (or affected) and the contexts—cultural, social, political, economic, ecological—in which their interactions and the problem are embedded (Duit & Galaz 2008; Kahane 2004; Levinthal & Warglien 1999).

The field of "collective intelligence" that has been developing rapidly since the late 1980s represents one area of research, scholarship and practical endeavour that has made advances in understanding how to harness the power of insights and ideas from large, diverse groups of people. These groups are better known in the CI literature as "crowds" (see Surowiecki 2004)

Previous speeches and papers on a "new synthesis in public administration"[21] have observed that governments need to develop their ability to tap the "collective intelligence" of citizens and other actors in order to address complex public policy issues (Bourgon 2007, 2008, in press). This claim rests on the assumption that citizens and other actors have valuable information and insights to share that can improve the foresight and decision-making of government, helping to manage and resolve complex public issues.[22]

In order to bolster the ideas previously presented in the "new synthesis" research, this paper provides a quick scan of existing research and practice related to the use (or promises) of collective intelligence in public administration. In particular, this paper focuses on

- key ideas and research findings about collective intelligence;
- how governments have been tapping it and/or promising practices in other sectors from which governments can learn; and
- guidance for governments on how to improve their ability in harnessing collective intelligence.[23]

Admittedly, some commentators have remarked that large scale interactions, and the collective knowledge gained through them, have to this point tended to be "incoherent and dispersed," with varying levels of success and quality (Klein 2007: 1). As a result, this paper also tries to gauge the challenges, barriers and limits to collective intelligence approaches.

[21] See http://www.ns6newsynthesis.com

[22] It also rests on some of the propositions that are driving the field of collective intelligence that has been developing since the 1980s, including: collective knowledge and action can achieve higher order results than individual thought and action; diversity of insights provide better definition of the issue and the system in which it is embedded; diversity of ideas provide more options for solutions and action; broad engagement and inclusive dialogue creates conditions for collective action; information and communication technologies allowing for broad reach, and the warehousing, mining, recombination of large amounts of information from diverse sources.

[23] Examples and links are included in the paper solely for informational and illustrative purposes. They should not be understood as endorsements or as signaling a "best practice".

4. KEY IDEAS ABOUT COLLECTIVE INTELLIGENCE

Theories of collective intelligence (CI) hold that groups, organizations, communities, or societies can (and often do) act intelligently as a cohesive, living system (Malone 2008). Families, countries, companies, and other conglomerations of people operating as a collective can accomplish feats that seem intelligent. They can achieve things together that they cannot achieve by acting alone. To be fair, there are also many examples of "collective stupidity".

Given this characterization collective intelligence has existed for some time, if not since the beginning of human communities. The field of CI did not gain prominence, however, until the 1990s when the innovation and widespread adoption of modern communication technologies, including personal computing and the Internet, enabled the development of new and advanced avenues for i) storing, mining and circulating massive amounts of information and ii) providing a basis for mass collaboration (Malone et al. 2009).

Large scale collective interactions have resulted from these developments. These interactions, in turn, have demonstrated some potential to assist in the predictive and decision-making functions of society. Generally, they present avenues for better understanding and addressing complex challenges, including public policy and governance issues (Klein 2007). CI approaches and systems are considered "most useful in situations where the resources and skills needed to perform an activity are distributed widely or reside in places that are not known in advance" (Malone et al. 2009: 15).

For those who wish to explore key ideas about collective intelligence:

An introductory text is available for viewing at http://www.scribd.com/doc/2459728/Collective-Intelligence-Creating-a-Prosperous-World-at-PeaceComplete-Book-minus-jacket-flaps

Another source is the Centre for Collective Intelligence at MIT: http://cci.mit.edu/

While CI systems are not currently seen to be appropriate for supplanting traditional decision-making, they can support a broad analysis required for developing creative interpretations, exploring options for action, and for making intermediate decisions. Final decisions are left to those assigned to the task, such

as governments; however, CI expands the tools available for informing their creative thinking and decision-making processes (Malone et al. 2009).

At present, the most prominent examples of CI approaches are seen to be within the private sector, particularly in some organizations which operate in an online format. Google and other search engines, for example, use collective data created by amalgamating results from millions of individual websites to produce intelligent answers to queries. Wikipedia uses simple organizational principles to operate as an open source for users to contribute to an ever-expanding online knowledge database. Collective use and user contributions, at least in theory, expand the diversity of knowledge inputs. Diversity of people, contributions and functions can provide a broader range of options in the face of adversity.

A number of companies today are also beginning to use CI for prediction markets—essentially futures markets in ideas—to complement traditional polling and market research techniques; this in a drive to shape and define their futures (Malone 2008).

FORMS OF COLLECTIVE INTELLIGENCE

Atlee (2008) outlines eight different forms of CI, based on various elements of particular collective processes. These elements affect both the organization and the potential outcomes of collective deliberation and thought. It should be noted that other forms, or even various combinations of these eight, may also exist.

1. *Reflective CI* refers to individuals refining their thoughts through group dialogue and deliberation. This entails capturing diverse opinions to create a more complete picture of the issue at hand. The collectively derived picture that emerges has a level of complexity and nuance that the individuals involved could not have derived on their own.

2. *Structural CI* emerges from social situations and systems that are explicitly designed—or structured—to support particular kinds of collective action. A situation example is where chairs are placed in a circle rather than rows in order to support a discussion. A system example may be the use of corporate policy frameworks (versus prescriptive policies that specifically detail the actions required to be in compliance) that give latitude to organizational members in terms of how they go about complying with

the policies and thus allow room for collectively intelligent action to emerge. Unlike highly prescriptive laws, framework laws are designed to give actors room to make 'intelligent' decisions while still complying with the law. Structural CI means that each member is positioned to contribute their intelligence because the social system and structures foster an environment to encourage such behaviour.

3. *Evolutionary CI* refers to the means by which patterns of relationships and knowledge have evolved over periods of time. This can include embedded wisdom or patterns of success that emerge within an organizational unit or group. Structuring evolutionary developments in an intentional fashion may be difficult, but analyzing them in retrospect or real-time may provide valuable lessons for the future and for other contexts. Due to the evolutionary CI within a particular group, certain ideas or "truths" may develop and become common knowledge over time yet remain relatively unknown to other groups who could benefit from them.

4. *Informational CI* entails a flow of information through communication channels as well as widespread gathering and availability of information, for example, in database form. Informational CI usually entails universal access, multiple authors, and collective action to create and edit information.

5. *Noetic CI* refers to the ability of groups to achieve esoteric or new ways of thinking. It entails the development of new ideas through the sharing of subjective experiences, with hopes that changes in thought processes can be achieved through dialogue.

6. *Flow* or *mutual attunement-based CI* can be understood as a dissolving of boundaries and barriers within a group. This allows individuals within the group to tap the individuality and unique capacities and ideas of each member in the context of collective activities. It entails the harnessing of group potential towards solving a common issue or achieving a common goal. Some examples may include improvisation theatre, or the idea of collective consciousness.

7. *Statistical CI* approaches reflect the level of predictive power and collective problem solving that can be achieved through aggregation of answers or responses of large segments of populations, often with little contact between individuals. An example of statistical CI is the beta

testing process for software whereby error messages from individual computers are automatically sent to a central database that aggregates them so that bugs and dysfunctions can be identified and priorities for further development set.[24]

8. *Relevational CI* refers to the unintended ideas and solutions that can emerge from group processes that are a by-product of the group dynamic. An example is a discussion that creates a misconception or misunderstanding between individuals that, unintentionally, spurs on a desired outcome or reveals a solution. The conflict that stems from misunderstanding allowed for a new direction in dialogue that leads to new proposals and change. While there is a large element of chance in this process, it speaks to the various ways in which answers can emerge from a group dynamic.

Innovation through CI will tend to emerge through a combination of a few of these orientations. Public administrators interested in social change and innovation may focus on the first four orientations because they can influence and, to some extent, control the process by which each from of CI emerges from them. The latter four forms of CI tend to exist as byproducts of group interactions in a heavily experiential and nonlinear fashion. Bringing these orientations together in thoughtful and productive ways is central to harnessing the capacity that CI may offer (Atlee 2008).

5. TAPPING AND HARNESSING COLLECTIVE INTELLIGENCE

Collective intelligence offers a number of specific tools that can provide inputs to decision-making and predictive functions. These tools tend to provide facts, opinions, and knowledge to help shape the way decision-makers can understand particular issues. They can provide additional insight into the concerns at hand before a final solution is reached. This section looks briefly into the different tools that CI approaches offer and that may have applicability within a public sector context.

[24] A caveat to this form of CI is that it may be less useful, and even inaccurate, if used for aggregating statistical data that requires subjective interpretation or where there are questions about what the dependent and independent variables are, or where there may be intervening variables and possibilities for spuriousness.

DECISION-MAKING THROUGH VIRTUAL NETWORKS

Web 2.0 technologies such as wikis, information markets, social networks, collaborative software, and other web-based tools are seen to provide avenues for the using CI in a decision-making capacity within public organizations (DiGiammarino and Trudeau 2008). These technologies can significantly change the scope and nature of decision-making capacities as they create open, virtual networks that harness the advantages that collective practices and approaches may offer (DiGiammarino and Trudeau 2008).

Web 2.0 technologies assist in outreach by expanding the information base in the collection and generation of ideas, whether as inputs for design or for assessment and evaluation. Outreach entails the inclusion of groups into the decision-making process that have not been traditionally included. This might consist of reaching "across hierarchical or functional barriers inside the organization" or obtaining "help from the outside" (Bonabeau 2009, 47). These technologies can be supportive of a range of practices in public administration that have taken hold over the last two decades, including the shift in practice in public administration towards horizontal management, shared governance and public participation, all of which require outreach.

Virtual networks are becoming an increasingly useful tool within public sector organizations. One example is The Collaboration Project of the National Academy of Public Administration. Participants such as the Office for Environmental Information use virtual networks to incorporate diverse information sources and expand organizational knowledge beyond traditional barriers (DiGiammarino and Trudeau 2008). More information is available at: http://collaborationproject.org/display/home/Home

Furthermore, organizations are now capable of compiling and analyzing in various ways widely-sourced material. An example may be asking a large group of people to estimate something and then averaging the responses to create an answer. Often, the results of such an exercise are highly accurate (Bonabeau 2009). Applying this concept can entail aggregating data from groups, such as experts in the domain who have been traditionally involved in informing decisions; but new, open technologies also allow for broader reach to provide

findings and ideas that are reflective of a more diverse knowledge base. Maintaining a balance between diversity and expertise is seen to ensure useful, well-rounded responses (Bonabeau 2009).

Web 2.0 technologies also allow for a form of self-organization within collective intelligence systems. Examples include that of Wikipedia or Intellipedia, an online database generated for the United States intelligence community. These applications allow individuals to create value within a collective context through addition, peer review and revision to an open database (Bonabeau 2009).

Virtual networks are not seen as eventually supplanting currently existing physical networks; rather, they are viewed as complementary. They provide opportunities to connect multiple points between networks—for example, when employees who work across the country from each other are able to interact and share ideas through them. That they can do this in real time is a valuable asset. It results, for example in savings related to the direct costs and opportunity costs associated with travel. Virtual networks allow for the development of connections in a widely accessible and economical way, offering opportunities for the generation and analysis of large volumes of information and broad engagement. In terms of making connections and fostering greater engagement, three potential forms of virtual networks are identified in the organizational literature: (1) leaders to frontline employees, (2) leaders to stakeholders and/or customers/citizens, and (3) peer to peer (DiGiammarino and Trudeau 2008).

(1) Virtual networks connecting leaders to frontline employees allow decision makers to connect with the frontline workforce and gain insights from staff who are more intimately involved with service delivery. One example is the aforementioned Intellipedia wherein connectivity is pushed to the frontlines to drive innovative

In the United States, the Transportation Security Administration (TSA) launched IdeaFactory in 2007 to improve the agency's performance. Using Web 2.0 technologies, IdeaFactory is an internal intranet site that harnesses the collective wisdom of employees by providing opportunities to input suggestions and comments. Within a year of implementation, over 4,500 ideas had been submitted, along with 39,000 comments. It is reported that over 20 of these ideas have been adopted into national policy for the TSA. More information is available at: http://collaborationproject.org/display/case/Transportation+Security+Administration%27s+IdeaFactory

practice (DiGiammarino and Trudeau 2008).

(2) Project or organizational leaders are also capable of engaging a *broader span* of stakeholders and citizens using virtual networks; allowing applicable private and not-for-profit organizations to collaborate and share with government through virtual networks expands the information available to decision-makers. Engaging organizations outside government through virtual networks enhances the ability of government and stakeholders to operate successfully towards a *common purpose*. Collaborative virtual networks invite citizens into the governance process, connecting decision-makers with previously inaccessible information and providing citizens with a more insightful view of government (DiGiammarino and Trudeau 2008).The low cost and ease of access of virtual networks facilitate this increased collaboration further.

(3) Finally, peer to peer networks within public organizations allow for horizontal communication and engagement between networks. Across government, communities of practice are increasingly at work establishing web portals, wikis, blogs, and discussion boards to exchange information and ideas around common interests and fields of endeavour. This model emphasizes high levels of interconnectivity. The key to success becomes less about control and more about having linkages to the ideas, data and people that will help to accomplish what needs to be done (DiGiammarino and Trudeau 2008).

INNOVATION COMMUNITIES

Innovation communities are broad networks consisting of individuals or organizations that are connected by a mix of face-to-face, electronic, or other forms of communication. These are communities in the sense that they are based on "interpersonal ties that provide sociability, support, information, a sense of belonging, and social identity" (Wellman et al 2002, 4). But, at the core of these communities is a drive for innovation and new ideas.

Beta-testing communities for software debugging represent a common example of innovation communities. In designing software, programmers are faced with the expensive and difficult issue of identifying and properly repairing subtle code errors or bugs within software. Opening up trial versions of new software to a large community, however, provides independent users the opportunity to test and report bugs in the programming. This reporting can even be done automatically through error messages that are sent back to the programmers. It is believed that given a large enough beta-testing and co-

development base almost every problem can be characterized quickly; in other words, "given enough eyeballs, all bugs are shallow" (Von Hippel 2005, 95). Each user, or each engaged individual, has a different set of ideas and assets in place. The assets of one user may be found to be a "just-right fit" to a particular problem.

Innovation communities are seen to serve as a complement or alternative to more traditional patterns of concentrating resources on a few pre-selected potential innovators. They offer a lower-cost way of searching broad areas for answers, ideas, and innovation. When the cost of high-quality resources for innovation becomes low, as it is within innovation communities, the resources can be diffused widely to engage a significant number of potential innovators around a common purpose (Von Hippel 2005). These communities offer potential solutions for problem solving and ideas within decision-making processes, and can also be engaged for troubleshooting and reflection.

Innovation communities demonstrate potential for the development of new ideas. One example is this is the wind turbine industry. A collective of Danish agricultural machinery manufacturers and motivated 'hobbyists' harnessed collective innovative potential through a grassroots movement that eventually gained a more significant stake in American markets for wind power than that of the National Aeronautics and Space Administration (NASA), the other main investor in this technology market. Utilizing a co-operative and innovative ownership model, the Danish company gained political support to integrate their wind power technology into the national electricity grid. This organizational structure proved more capable and innovative than the more traditional centralized NASA model wherein scientists utilized a top-down development approach to perfect a wind turbine model without any significant input from the owners and users (Douthwaite 2006).

CIVIC INTELLIGENCE

The idea of innovation communities within a democratic context leads to the concept of civic intelligence. This form of CI is focused around the ability of individual citizens, groups,

The "Fix My Street" initiative in the United Kingdom is an online wiki that allows citizens to report issues within their local community. Issues are detailed by users and then broken down into overall categories to form a 'to-do' list for the local council. More information is available at: http://collaborationproject.org/display/case/Fix+My+Street

organizations, and society as a whole to conceive of and implement effective and sustainable approaches to shared issues and concerns (Kesler, Schwinn and Schwinn 2008). Civic intelligence takes shape through deliberative democracy and community building initiatives. Public input becomes central as a means of ratifying important decisions made by business or government. Civil society also can be put into a position of leadership on various public issues.

The benefits of this approach are seen to extend beyond the legitimacy that civic engagement lends to a decision-making process. Civil society on the whole is seen to be more trustworthy and reliable than business and government[25], and as such is seen as more likely to be capable of operating as an honest broker of social initiatives (Kesler, Schwinn and Schwinn 2008).

PREDICTION MARKETS

Using CI in an idea-based market structure can provide a predictive capacity that may be useful for public organizations. Prediction markets rely on a dynamic trading model similar to financial markets to generate group forecasts for a particular phenomenon. Essentially, they involve the creation of "betting markets" on a topic with a view to eliciting more accurate estimates (Hanson 2007, 73).

Google has been experimenting with internal prediction markets that aim to answer questions such as how many users gmail will have or whether certain projects will be delivered on time. Employees are given "Goobles" to invest in securities which represent specific answers to these questions. Securities are traded in markets, where their relative values provide predictive information to management. More information is available in an online paper: http://bocowgill.com/GooglePredictionMarketPaper.pdf

Organizations such as Government Futures attempt to provide insight on future government activity using prediction markets to determine such things as expected future IT spending and technology procurement trends in government. For more information see http://governmentfutures.com/

Prediction markets may be useful in testing the predictive value of analysis and perception. They provide a mock view of the potential of various phenomena, including policy proposals and other ideas, gauging the perceptions of the "crowd" of investors in different

[25] See the Edelman Communications trust barometer for 2009 at http://www.edelman.co.uk/files/trust-barometer-2009.pdf.

phenomena based on relative market values (Abramowicz 2007). These markets act as a kind of forecasting institution, potentially capable of informing decision-making, and changing information flows through a more open kind of crowd-sourcing tool (Hanson 2007).

Prediction markets have the potential to improve public policy as they "make it easier for the public to assess government policy" (Abramowicz 2007: 93). Another benefit of prediction markets is their reliance on, and provision of high levels of transparency. Prediction markets are seen, at least in theory, as being capable of accomplishing some of the tasks traditionally reserved for legislatures and administrative agencies in a way that is more collective, representative, and better informed. Full implementation of this idea, however, may require exposure and testing to allow the public at large to appreciate market approaches to prediction and decision-making (Abramowicz 2007).[26]

4. GUIDANCE FOR PUBLIC ADMINISTRATORS

Collective intelligence systems have emerged predominantly within the private sector; however, various lessons about organizing and using CI approaches may be relevant for public administrators.

In Europe and North American, the traditional management paradigm has tended to reflect a primarily individual dynamic. Increasingly, a more collective orientation to the management of organizations, with "intelligent" modern enterprises characterized by collective performance, is considered valuable (Zara 2004). While a focus on individual performance has been deemed sufficient for traditional industrial and commercial companies, the sustainability of modern organizations may be significantly impacted by how well they adapt to collective processes (Zara 2004).

Using Malone, Laubacher and Dellarocas' work (2009) as a foundation, this section identifies the "building blocks" that can be combined and recombined in designing and managing collectively intelligent organizations. These building blocks are related to two related sets of questions:

[26] A scan of the world-wide-web captured only one reference to a government agency using prediction markets—it was purportedly in Singapore's Agency for Science, Technology and Research (see http://egovau.blogspot.com/2008/08/can-we-use-prediction-markets-to.html). However, this claim cannot be corroborated from a search of the agency's website.

- Who performs tasks in CI systems? Why do they perform them?
- What does a CI system aim to accomplish? What process and structure is used?

"Crowd structures" are an integral part of collective intelligence systems. The following section contrasts the differences between crowd structures that support collective intelligence with hierarchical structures that support more traditional forms of organizational intelligence.

WHO IS INVOLVED?

Under traditional hierarchical structures, the question of who undertakes or takes ownership of a specific task or issue "is typically answered when someone in authority assigns a particular person or group of people" to it (Malone et al. 2009: 4). In contrast, within a CI system "activities can be undertaken by anyone in a large group who chooses to do so, without being assigned by someone in a position of authority" (Ibid.: 4). These large groups, which are known as "crowd structures" in the CI literature, are common to collective intelligence systems. They are the central enabling feature of CI systems, particularly when working through an online format. In general, collectively intelligent systems are seen to consist of open crowd structures "where anyone who chooses can participate" (Ibid.: 4).

WHY, AND WHAT INCENTIVES?

Traditional organizations and markets tend to operate on the basis of financial motivation. Direct payments, such as a salary or potential financial gains in the future, provide an impetus for individuals to perform tasks, including the tasks of enhancing their reputation or skills. These incentives also serve as motivators in crowd structures, but they are not the only or even the main motivating factors. In collective intelligence systems, people can be motivated by the enjoyment of participating, whether this results from the social dimension of the activity, from the intellectual challenge, or from a sense of satisfaction in contributing to a worthy cause or helping to improve something. Glory and recognition are other important motivators. Collective intelligence communities provide opportunities for achieving recognition through contributor lists or

"Top contributor" lists and performance based classes that conferring status, such as "top reviewer" on Amazon or "power-seller" on E-bay, create numerous alternative incentives to financial motivations for user contributions (Malone et. al 2009).

conferring degrees of status based on contributions. This, combined with a collective passion for the subject of the contribution, align as strong motivators for collective intelligence systems (Malone et al. 2009).

WHAT IS THE GOAL, AND HOW TO ORGANIZE?

Collective intelligence systems can be structured in a variety of ways. How they are organized and managed depends upon the goal associated with them. CI systems often combine elements from a wide variety of organizational structures; in fact, they may rely on some form of hierarchy to accomplish particular tasks. Malone et al. (2009) identify purpose (i.e., whether the system is used to create or to decide) and the level of dependency between actors in crowd structures (i.e., whether people act independently or whether there are strong dependencies between their actions) as two main considerations (see Table 1 which is adapted from their work).

Table 1: Purposes and Levels of Dependency in Collective Intelligence Systems

Purpose of CI System	Level of Dependency in Crowd Structure	
	Independent	**Dependent**
To create	Collection	Collaboration
To decide	Individual Decisions	Group Decision

Collections refer to CI structures in which "the items contributed by members of the crowd are created independently of each other" and then form part of a repository, or collection (Malone et al. 2009: 6).

Collaboration involves situations where "members of a crowd work together to create something and important dependencies exist between their contributions" (Malone et al. 2009: 6).

Collection can entail contests, such as those held by InnoCentive, where users submit solutions to complex problems in order to compete for cash prizes. More information is available at: http://www.innocentive.com/

"Open source" initiatives, such as Linux software and Wikipedia represent examples of collaborative collective intelligence systems. More information is available at: http://www.linux.org/ *and* http://wikipedia.org/

Group decision approaches to CI systems consist of cases where "inputs from members of the crowd are assembled to generate a decision that holds for the group as a whole" (Malone et al. 2009: 7). In outlining various decision-making processes that include crowd structures, Malone et al. (2009) describe a number of variants of the group decision model. These include voting, consensus, averaging, and prediction markets.

Voting has become an increasingly viable option for making decisions in a greater number of circumstances because advancements in technology provide both reach and efficiency in the process.

Consensus refers to a situation where all, or essentially all, group members can been deemed to have reached agreement on the final decision.

Averaging can be used in cases where decisions basically involve picking a number or to average the numbers contributed by members.

Prediction markets, discussed earlier, are a way of enabling crowds to estimate the probability of future events. These probabilities inform final decisions.

> *In 2001 and 2002 NASA allowed the general public to view photos taken from the surface of Mars over the internet. Users were given the opportunity to contribute coordinates of crater locations. The averaged result of the coordinates provided by the 'Clickworkers' proved to be just as accurate as classifications made by experts (Malone et al. 2009).*

Individual decisions refer to CI systems where "members of a crowd make decisions that, though informed by crowd input, do not need to be identical for all" (Malone et al. 2009: 9). Variations on this concept include markets and social networks.

Markets involve a formal exchange of some kind (e.g., money) to assist in decision-making. Individual purchasing decisions by a crowd can provide an indicator of collective demand, thereby impacting availability and pricing. In turn, the actions of sellers can influence crowd purchasing decisions in a market context.

> *In youtube, users can rank other contributors as their "favourite". In facebook, they can accumulate "friends". In both cases, users create affinities and assign levels of importance within their relationship in the crowd. For more information, see: http://www.youtube.com and http://www.facebook.com*

Social Networks entail relationships between members of a crowd often centered on similarity of viewpoint and

interests, or other characteristics held in common across a network. Crowd members are capable of assigning varying levels of importance to individual inputs within the context of their relationship with other members of the crowd.

The building blocks outlined above can be combined and recombined depending on the goal one has for using a system of CI. It also depends heavily on the context in which the system will be operating.

> *"Building blocks" of CI can be recombined in varying ways according to the purpose and need. 'Threadless', an online T-shirt company uses collective processes for the creation of designs in a crowd structure through a contest approach. It then harnesses the results of an online crowd-based aggregate rating system to decide which designs are best liked by the community, and uses an internal management/hierarchy approach to ultimately choose which submissions are sold through their website (Malone et al. 2009).*

A public administrator who wants to tap CI has a number of choices to make. Clarifying the goal and context is particularly important. CI can be used for the creation of new knowledge and ideas; it can also be used in decision-making processes. To support the former, an administrator can use certain approaches. They can generate a collection of individual ideas, hold a contest, or seek collaboration within the crowd. To support decisions, an administrator can use voting, prediction markets, averaging, consensus, and social networks. The types of crowd structures to be used must also be determined. If a suitable crowd or collection of people does not exist, an administrator may be better off using a hierarchical model for their intelligence system or a hybrid of hierarchy and some collaboration. The administrator must also consider the motivations people will have in being engaged and what incentives may be helpful in securing (and sustaining) their participation.

Finally, a CI system can be designed in such a way that varying modules, each combining the building blocks in different ways, work with each other. For an example, please refer to the 'Threadless' business model described in the text box on this page. Creative use of multiple forms of collective intelligence systems provides a variety of possible avenues for accomplishing the complex policy goals facing modern public administrators.

5. CHALLENGES AND LIMITS TO COLLECTIVE INTELLIGENCE APPROACHES

In considering the use of CI approaches in public administration, there are a number of cautionary points that need to be made. In particular, concerns have been raised regarding loss of control, the shift away from expert opinion, engagement issues, policing, and intellectual property.

A key concern common to all forms of CI is a loss of control. Crowds are generally unmanageable, and collectives can make decisions that run counter to the original intent of engagement. CI forms of decision-making can be unpredictable, and organizations may not be entirely equipped to deal with the issues that get raised in and through crowd structures. When executed properly, tapping into CI for diverse results may offer promise in achieving superior outcomes; however, in some cases crowds can veer in unexpected or harmful directions and the resulting damage can be difficult to contain (Bonabeau 2009).

Furthermore, CI does not represent a panacea for making predictions or arriving at decisions. Some problems are more appropriate for collective approaches than others, and a careful judgment needs to be made as to whether collective input or specific expertise is a better choice. It is also important to consider the motivations of those who will participate in collective processes and the impact that certain incentives may produce. Furthermore, collective processes may become stagnant over time. Engaging a continuous flow of new and enthusiastic participants can be challenging, but it can help to keep motivation high (Bonabeau 2009).

A number of issues arise within group scenarios with respect to how they can be appropriately moderated or otherwise "policed". Groups are capable of providing valuable insight into decisions, but they always contain the capacity for misbehavior, particularly as their size increases. Policing to control such behavior is warranted—for example, administrators at Wikipedia monitor and change content—but the implications of controlling the crowd often runs counter to the original intent of bringing in new and diverse points of view and ideas. Excessively conservative decisions tend to result from strict environments (Bonabeau 2009).

The ownership of ideas and intellectual property has also become a concern in CI approaches. Encouraging innovative behaviour, ideas and contributions requires protection and ownership to ensure that the work required in the creation process is duly noted. Not recognizing the contributors and owners of ideas creates disincentives to the work. Determining how intellectual ownership is claimed and assigned within collective processes is a complicated matter. Policies on this need to be made clear from the inception of a CI project to avoid messy conflicts (Bonabeau 2009).

6. CONCLUDING THOUGHTS

The literature on CI that was scanned for this paper has a number of helpful ideas for public administrators. The CI literature provides a different lens than those traditionally used in public administration for looking at collective practices, challenging administrators to think in new ways about how to shape collaborative processes and to work better in a collective context. It provides observations on how they might use technologies, such as Web 2.0, to improve collaborative work in a public sector context. It also shows how CI approaches may provide valuable inputs to decision-making processes. If a public administrator wished to pursue a CI approach, Malone et al.'s "building block" model provides a pragmatic list of components for administrators to consider in shaping CI systems.

At this time, CI as a field of research and practice is in relatively nascent form. Some of its researchers and practitioners have very high aspirations for the wisdom of crowds and the strategies and means that can be used to tap this wisdom. This combination of novelty and aspiration suggests that caution may be needed regarding some of the claims in this literature, at least as they apply to public sector organizations.

There are a number of guiding examples of CI systems that have emerged, most of which are from the private sector. This raises questions as to whether governments are behind the curve in adopting CI approaches and, if so, why. Is there something about these approaches that does not resonate within the concerns and practices of public administrators? If so, what it is about CI that is not attractive to public administrators? Have public administrators not adjusted to new paradigms and realities? Or, have they acknowledged them but decided they are not appropriate?

Another possibility is that public sector examples may exist, but they are being studied in a different body of literature using different theoretical concepts—for example, in the literature on citizen engagement, e-government, knowledge management or statistics.

For the purposes of the "New Synthesis" project, a suggested next step is to look for guidance regarding collectivist approaches through a review of more formally established lines of research and practice in public administration, such as service delivery, citizen engagement, planning, decision-making and the policy process.

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LITERATURE SCAN #5:

Disentangling Performance Management Systems from Control Systems

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SUMMARY

In the public sector, the way activities are carried out is often as important as the results that are achieved. Control systems are needed to ensure public servants comply with the laws, regulations and management policies that govern their decisions and actions. Performance management systems are needed to ensure public servants have the information, knowledge and tools they need to continually improve their decisions in order to achieve better results.

While being mutually reinforcing, performance management systems and control systems serve different purposes and should have distinct identities. Control systems are about compliance to ensure and prevent risks of corruption, fraud, mismanagement, and misappropriation. Performance management systems are about the improvement of results, better decision-making, experimentation, learning, and innovation. Despite their differences, these two systems have become entangled. Through forty years of public sector reform, there has been a progressive integration of audit, evaluation, budgeting, planning, control, performance measurement, and performance management systems. Nowhere is their entanglement more obvious than in the area of performance measurement. The use of performance measurement predominantly for control and compliance purposes has led to a series of conceptual, motivational, and technical problems that serve to reduce the value of both performance and control systems.

This paper explores the literature on performance management, performance measurement and control in light of the proposition that it may be necessary to disentangle the two systems in order to get greater value out of both. It finds evidence to support this proposition.

INTRODUCTION

Since the 1980s, public sector reform agendas in many countries have continuously sought to improve the efficiency, productivity and accountability of public organizations (Christensen and Laegreid, 2007). In many cases, these reform efforts have resulted in an increasing use of performance measurement and a growing burden of controls and reporting requirements.

Some of the other key developments during this period include the expansion of traditional auditing (i.e., for compliance with rules) to auditing for "value-for-money"; the widespread use of targets and service standards; and the use of performance measurement in support of results-based budgeting, performance pay, and program evaluation.

There is no compelling evidence the current approach has significantly enhanced decision-making in government or improved public value. There is no compelling evidence it has contributed to efficiency, effectiveness and accountability in the public sector organizations.

Indeed, there is mounting evidence that the current approach undermines these goals. The increased emphasis on using performance measurement for control and compliance purposes in public organizations, which are already burdened by numerous controls and rules, may create a *risk-averse culture, stifle innovation and prevent organizations from learning and improving results*.

Disentangling compliance and performance management systems might be necessary to reduce the need for *ex ante* controls and to facilitate learning, responsible risk taking and innovation—and, with these, higher performance.

DISTINGUISHING CONTROL SYSTEMS FROM PERFORMANCE MANAGEMENT SYSTEMS

In the public sector, *the way activities are carried out is often as important as the results that are achieved*. This emphasis on both process and outcome supports democratic conventions, principles of good government and the drive for results of high public value.

To realize these principles and outcomes in practice, *control systems are needed to ensure that public servants comply* with the laws, regulations and management policies that govern their decisions and actions.

In addition, p*erformance management systems are needed to ensure that public servants have the information, knowledge and tools they need to continually improve their decisions in order to achieve better results*.

Control systems and performance management systems are both needed in the public service, but their purposes are different and at times even in conflict (Aucoin, 2001). Table 1 provides some distinctions between these systems.

Table 1: Distinctions between Control Systems and Performance Management Systems

	Control Systems	Performance Management Systems
Purpose:	Reduce the risk of mismanagement to ensure full compliance with rules	Improve decision-making to achieve better public results
Means:	Checks and balances, assurance systems, inspections, audits, compliance and enforcement, deterrence (incl. disciplinary measures and legal recourse)	Information and learning systems, monitoring and feedback, performance measurement, evaluation, experimentation and innovation, incentive system
Characteristics:	Objective	Subjective
	Stable	Dynamic
	Rule-based	Decision-maker-based
	Enforceable	Useable
	Evidence-based	Information-based
	Factual	Meaningful

Control systems *aim to reduce the risk of mismanagement*, including misappropriation, abuse of power and authority, corruption, and fraud. They exist to ensure that rule of law prevails, that due process is followed, and that public servants are accountable for their use of their delegated authorities. These process requirements are not negotiable. They apply to all public servants and public organizations, and they are needed, valued and respected.

The mainstay of most control systems is the audit function, with its preoccupation with the regularity of government accounts and the compliance of expenditures with constitutional and legal requirements (Levy, 1996). The purpose of audits is to provide accountability of the executive to the legislature. Control systems are also anchored in public sector values, such as probity, respect for the rule of law and the democratic, professional and ethical values that are fundamental in a public sector setting (Lepine, 2007).

A good control system is objective, stable, auditable, rule- and evidence-based, non-negotiable and enforceable. It includes disciplinary and punitive measures. Without these characteristics, there is no objective means for recognizing compliance from non-compliance and for taking the appropriate steps to deal with the latter.

Performance management systems are needed to ensure that public servants and their organizations achieve public results of increasing value by continually improving their performance. The ultimate goal of performance management is to *improve decision making* in government at all levels in order to achieve better public results and *enhance the net public value* of those results (Bourgon, 2008).

The fundamental test of a good performance management system is that it is used to improve decisions that lead to better results. A good performance management system helps identify and remove the obstacles to better results, sheds light on the reasons for failures and success, and supports learning, innovation and continuous improvement.

Performance management systems rely on information and knowledge as inputs. Better knowledge about results, outcomes and impact should form part of the learning and feedback process to improve results. Performance management is an instrument for innovation and performance improvement. It should help governments to rely on learning and invention rather than on instruction and command. It should inform the political process by bringing

relevant information on the outcome and impact of policy choices to the attention of ministers and elected officials.

Performance measurement is a necessary component in any good performance management system. But performance measurement is only one element and should not be construed as capturing the whole picture of the process of achieving and continually improving results. Choosing which indicators to include in a performance measurement system is a subjective process. The value of these indicators exists in the interpretation and meaning that is brought to them. The subjective nature of performance measurement does not exclude the opportunity for comparative analysis. Similar indicators in similar policy domains can be compared to foster learning, innovation, and the achievement of better results.

THE HISTORY AND CURRENT STATE OF PERFORMANCE MANAGEMENT

Throughout the second half of the 20th century, the focus on performance in the public sector expanded. Planning, Programming and Budgeting (PPB) came first, followed by Management by Objectives (MBO) and Zero-Based Budgeting (ZBB). Introduced in the early 1960s, PPB systems aimed to identify the objectives of government programs and the most efficient and effective means of achieving these objectives based on a comparison of the costs and benefits of various alternatives. PPB was largely abandoned in the 1970s. It was replaced by MBO and ZBB. MBO consisted of participative goal-setting and decision-making in regards to the achievement of the agreed upon objectives within an organization. ZBB focused on the justification of budget requests by starting each budgeting cycle from "zero" rather than using figures from previous years as the starting point.

In the 1980s and 1990s the field of performance management expanded once more. Governments were facing ambitious administrative reform efforts with respect to the management of public funds and assets. The dependence of New Public Management on scientific management has meant a continued reliance on *ex ante* controls, as well as an increased impetus for *ex post* quantification, value-for-money audits and related scientific evaluations, all backed-up with the increasing use of performance measurement. There was an expectation that policy and resource allocation decisions should be based on

information about the performance of public programmes. This preoccupation with performance was built on the assumption that it would bring real tangible benefits to the organization (Adcroft and Willis, 2005).

By the 1990s, various countries had applied performance management ideas to government activities. Performance management systems encompassed some of the following elements:

- Defining performance in terms of outputs;
- Setting measurable levels of intended achievement (i.e., performance targets and service standards);
- Determining the extent to which targets are achieved using performance indicators (i.e., performance monitoring and reporting);
- Allocating resource decisions based on performance information (i.e., performance budgeting and results-based budgeting);
- Performance pay based on performance measurement (Davies, 1999: 151).

In short, over forty years of public sector reform, there has been a progressive integration of audit, evaluation, budgeting, planning, control, performance measurement, and performance management systems.[27] Government-wide controls imposed by central authorities have been complemented with output controls. In some countries, controls have been associated with various "incentives" or "punitive" measures including resource allocation or performance pay. In too many cases this led to a number of considerable challenges, including an excessive proliferation of performance indicators (Gregory, 2007). The end result is an increasing cost of measuring and controlling compared to the benefits (Barzelay and Armajani, 1997). These costs and the constraints that are imposed on public organizations by a complex mixture of measuring, controlling and reporting impacts their capacity to convert inputs into activities, outputs and, ultimately, public results.

[27] The integration of control and performance systems has also taken place in the private sectors, with some dramatic, negative consequences. For example, the integration of auditing and management consulting functions in major accounting firms served to undermine the objectivity of the audit process.

THE CHALLENGES OF PERFORMANCE MEASUREMENT

The ultimate worth of a performance measurement system is the use is made of it to improve decision-making and thereby improve results. By that standard, and despite the progress that was made during the 1980s and 1990s, performance measurement in government is not performing well. The ideals with which measurement regimes have been incorporated into government management structures have not been met. The literature shows that contemporary performance measurement processes do not significantly contribute to decision-making in government, to improving of results by creating higher net public value, or to the achievement of efficiency, effectiveness and accountability in the public sector organizations.

Paul Thomas (2004), for example, argues that "performance measurement systems have generally been disappointing in terms of the actual use of performance data to guide decision-making and to achieve improved performance" (1). He notes measurement systems have rarely contributed in a demonstrable fashion to improved performance by public organizations. He also observes there are numerous recent examples of performance measurement systems being abandoned or scaled back because of their lack of utility in decision-making.

In an analysis of performance management practices in New Zealand and Australia, John Halligan (2007) cites a study by the auditor general which shows that performance measurement data was used as an input to resource allocation and policy development, but the actual *influence* of the performance data on decision making was mixed (58-59). Halligan also notes that the credibility of linking performance measurement to performance pay systems is questionable. Results show that a relatively low proportion of employees view such pay systems positively (60).

Numerous academics have discussed the negative impact that over-reaching control systems have on actual performance. The Kennedy School of Research on Innovations in government identifies "excessive orientation to constraints, and on rules and clearances that reflect those constraints, as crucial impediments to innovation and, hence, performance improvement" (Kelman, 2008:28-29). Similarly, it has been argued that the responsibility of the top executive leadership is to provide oversight to prevent unethical or inappropriate behaviour in their organizations. Beyond that, however,

"bureaucratic routines, with their formal rules and procedures, developed to ensure accountability, also suppress the legitimate exercise of executive initiative" (Levin and Sanger, 1994:11).

Gregory (2007) specifies why performance measurement leads to ineffective overall outcomes. He observes that "when a measure of performance is made into a target it quickly ceases to be a valid measure, since it will create powerful incentives for managers and operators to behave in ways that are quite rational in meeting targets but may be much less so in achieving organizational purposes" (232). Therefore, "the quest for ever more precise measurement of performance" impedes "the collaborative effort that is so often required for policy effectiveness."(233).

Christopher Pollitt (2000) observes three interacting types of problems arise as a result of the integrative approach to performance management and control. These include conceptual, motivational, and technical problems, which are discussed below.

CONCEPTUAL PROBLEMS

Conceptual problems arise as a result of the increasing theoretical and practical integration of control systems into performance management systems. These systems should be viewed as conceptually different as they exist to serve different purposes. Their integration is undermining their distinct identities and is eroding the value of both systems. Nowhere are these conceptual problems more apparent than in the ways in which performance measurement is understood and practiced.

Pollitt (2000) argues that an over-emphasis on performance measurement is not a practical approach due to the conceptual challenges associated with defining a good result in public policy. The "conceptual" problems of measurement imply that it is difficult to agree on what should count as a meaningful measurement. Values in public management and public policy are highly contested and what counts as "good" constitutes a different meaning for the various political, social, and public service groups. In more controversial areas such as social policy, performance measurement does not account for value differences among stakeholders and can lead to oversimplification of results. Furthermore, for complex public programs, sets of performance indicators can never be complete, or objective, or stable over long periods of

time because any set of indicators will never be large and diverse enough to capture all aspects of the program and issues it is trying to address. As indicators are debatable and change according to who is in charge, comparisons over time between organizations can become very difficult.

Carroll (2000) points out that the choice of indicators is not neutral because they measure different attributes and support the interests of some constituencies over others. As governments are increasingly tasked with responding to wicked problems and complex issues, measurement becomes even more difficult. In particular, the variety of results, the challenges to definition and design, and the questions about who decides what are "good" or "bad" results constitute the main challenges. The very nature of public goods makes a universally valid measurement of results in public sector organizations a nearly impossible task.

In addition, policy makers often set policy targets, determine inputs and prescribe how to achieve these targets without input from the organizations that will be tasked with implementing the polices. This, in turn, creates discrepancies when it comes to implementation because the targets are vague or unrealistic, and do not take organizational capabilities into account. As a result, the program may not achieve its targets, leading to tension and misunderstanding between policy makers and implementers, even if the program achieved significant results.

Finally, these conceptual difficulties result in the measurement of a component of a program while neglecting the whole program. This generates adverse implications because the components of a program being measured are hardly independent from the whole program. Once performance indicators are chosen, governments and managers have incentives to ensure progress on those fronts, thereby biasing results and diverting attention from other issues (Caroll, 2000). For this reason, improved performance in one area may well be the result of a targeting of resources from other areas, which can mean worsening performance elsewhere. Finally, scientific approaches assume objectivity but subjective interpretations of the evidence are mostly the case. The confusion about which part of programs to measure (and which parts are measurable) makes the measurement of results cumbersome to implement (Adcroft and Willis, 2005).

MOTIVATIONAL PROBLEMS

Control systems exist to ensure that actions are taken to reduce the risks of corruption, fraud, mismanagement and misappropriation. They exist to ensure that public servants and elected officials live up to high ethical standards and are deserving of the trust given them by citizens. Performance management systems, on the other hand, exist to ensure the continuous improvement of results, better decision making, experimentation and innovation. In this case, the integration of performance management systems and control systems leads to the loss of their intended purposes.

When performance measurement is used to ensure compliance, it becomes part of an over-reaching system of control. This can lead to a number of unintended, negative consequences for actual performance improvement, in particular with respect to the motivational issues.

Table 2: Motivational differences between control and performance management systems

Control Systems	Performance Management for Results
Take actions to reduce risks of corruption and fraud	Make better decisions
Take actions to reduce risks of mismanagement and misappropriation	Achieve better results
Live up to high ethical standards	Experiment, learn, innovate, evaluate, improve

One of the consequences of the enlargement of control systems and their increasing reliance on performance measurement is a heightening of motivational conflict. Performance measurement used for the purposes of compliance carries with it political ramifications both in the area of bureaucratic politics and the realm of external political accountability.

Take target-setting as an example. Setting targets for aspirational or benchmarking purposes as a means by which to learn from performance is one

thing. Setting targets and then holding one to account to them—that is, to be in compliance with them—is another. When the latter approach prevails, target-setting and performance measurement become an instrument of control. This changes the underlying dynamic for those subject to the targets from learning to managing the political risk of being seen to be underperforming.

Pollitt (2000) highlights that motivational problems associated with measurement have to do with "gaming" and other motivationally-based distortions that regularly undermine measurement systems. The introduction of any measurement system simultaneously defines an element of "politics" – either "real" politics (in the public and democratic sphere) or bureaucratic politics. Depending on measurement outcomes, individuals are liable to lose or gain reputation, prestige, resources, performance pay, career prospects, or power. The "politics of performance" lead to the following distortions: (i) the suppression of measures exposing persistent differences in performance, (ii) the redirection of activities or outputs to conform to measurement categories, (iii) the over-emphasis on things that are easily measured and the neglect of other equally or more important activities where measurement is more difficult or even unattractive.

Complex and challenging areas of policy and programs are particularly affected by the political nature of measurement. In an environment where 'what gets measured gets attention' and where trust is low, complex services are difficult to manage. Instead of focusing on the whole issue and program, public officials aim to avoid censure by concentrating on those specific aspects that are being measured. When employees are motivated to save face and seek out the maximum score in this way, at the expense of tackling the complex issues in an innovative way, an optimal environment, consisting of supportive behaviour and operating autonomy, which is a key to effectiveness, is lost (Pollitt 2000).

Thomas (2004) further emphasises the political, subjective, and value laden nature of performance measurement. In the adversarial realm of public political discourse, performance measurement is amplified by the media and used for aggressive partisanship. Davies (1999) argues that performance measurement systems have been asked to serve multiple users and multiple purposes—some political, others administrative. This can lead to the use of performance information for ends for which it was not intended. Performance information can be 'hijacked' to suit other purposes and communicated without sufficient

explanation or context. Therefore, the risks involved in the collection and publication of information around performance impose significant constraints on public servants who are aware that ministers want error free government. In the present context, public servants tend to view performance measurement as a managerial instrument to help with budget cuts. Thus performance indicators become a tool of control and compliance and not a learning or inspirational instrument. If performance measurement is connected to resource allocation, there is an even greater motivation for selective reporting.

Another motivational challenge is related to goal displacement. This phenomenon occurs when performance measurement creates incentives that direct effort towards meeting the requirements of measuring and reporting to the detriment of the programme's relevance. In other words, this happens when performance indicators and targets overtake the programme's raison d'etre. The risk of falling into that trap increases under the following conditions: (i) insufficient attention is given to the implementation process; (ii) the measurement approach reduces dynamic and complex multi-dimensional programmes to simplistic formulae and/or mechanistic linear processes; and (iii) the focus of the assessment effort is on cosmetics rather than fundamentals (Davies, 1999).

Finally, Greilling (2006) points out that for public bureaucracies, as a type of organisation, it is more important to meet external institutional expectations than to be efficient in a technical sense. The externally imposed efficiency indicators reduce the chances to act as a driver for making public service provision more efficient. The multidimensionality of efficiency (economic, political, democratic, social efficiency), the constraints under which public services operate and the ambiguity of public goals are just a few factors which make it difficult to subscribe to the notion of performance measurement as an efficiency driver.

TECHNICAL PROBLEMS

The technical aspect of performance measurement centres on the question of whether everything pertinent can be measured reliably, cost effectively, and in the right timeframe (Pollitt, 2000). Technical problems are related to the belief that information is already available to measure performance, that the information is neutral, and that all activities can be measured and quantified because 'what gets measured, gets managed' (Radin, 2006). When

performance systems and control systems are integrated, the misuse of performance information happens in a myriad of ways, including the following:

- Inadequate and growing amount of indicators that do not measure what they are intended to measure (Voets et al., 2008);
- The difficulty of establishing plausible causal linkage between inputs, outputs and desired or actual outcomes (Koppenjan, 2008);
- The link between activities and outcomes is usually taken for granted by those who carry out the programs and is treated as something obvious versus an intermediate step (Van Dooren and Van de Walle, 2008);
- A tendency to over-emphasize process, output, and economy and efficiency measures instead of measuring outcomes, quality, or user satisfaction (Bouckaert and Peters, 2002);
- The subjective measures and indicators cannot capture unanticipated effects or the symbolic meanings that are attached to programs and policies (Radin, 2006);
- A tendency to oversimplify the complex systems in which social and public policy operates, reducing complex systems to simple assumptions of cause and effect and ignoring many of the contingent factors that characterize the public policy environment (Haynes, 2003);
- The legitimacy of performance measurement is broken because measures, targets, and results released by governments are perceived to be massaged and manipulated (Speers, 2005);
- Performance indicators themselves are “raw data” which must be interpreted and mean different things to different stakeholders (Thomas, 2004).

The increasing preoccupation with performance measurement and controls can be assigned mainly to the following factors: (i) governments attempt to achieve balance between oversight and flexibility, often using mechanism such as public service reforms, and (ii) governments reaction to a decline in the public’s trust and confidence in institutions caused by real and perceived crises or scandals (Lepine, 2007).

In the first case, the tension exists between the emphasis on results and the emphasis on rules. The former focuses on learning, innovation, risk-taking and results before processes and the latter emphasizes prudence and probity, due processes, the primacy of law and regulation, and political accountability (Task force, 2000).

In the second case, performance measurement and management, like audits, are informed by (i) a fundamental distrust in public organizations due to "scandals" and (ii) the ensuing need to avoid future ones (Power, 1999; Cooper et al, 2005). Scandals provide grounds to question the legitimacy of authorities. In the face of such scandals, performance measurements are used as an "assurance" that measures and actions are being implemented to forestall future scandals; they are used to apportion blame to policy implementers (Speers, 2005).

For example, in the aftermath of the "sponsorship scandal" in Canada, a series of accountability and management improvements that consisted of 158 measures which focused on the expansion of audit activities, stronger financial controls and more reporting to Parliament. Arthur Kroeger (2006), a former senior deputy minister in the Government of Canada, stated that these measures failed to recognize the sponsorship scandal was not the result of a lack of regulation in the public service. Power (1999) also argues that there is no direct correlation between performance measurement and accountability and that more "accounting and auditing does not necessarily mean more or better accountability" (127).

Accountability encompasses "processes whereby citizens hold their governors to account for their behaviour and performance directly" (Aucoin and Heintzman, 2000, 245). The explosion of the performance measurement in the last decades is attributed to pressure from citizens for public officials to account for their stewardship. But using performance measurements as an accountability tool contributes to public disillusionments with government. "In a period where the public is disillusioned with government, achieving a more positive culture of performance-based accountability will be difficult" (Thomas, 2007, 17).

Finally, Romzec and Ingraham (2000) argue that there are four types of accountabilities, including hierarchical, legal, professional, and political accountability. The problem with performance measurement is that it places more emphasis on one type of accountability to the neglect of the others. Performance measurement is mostly concerned with measuring inputs and

outputs of public organizations against set targets and benchmarks. This means that it is primarily concerned with professional accountability.

SECTION SUMMARY

To sum up this section, the expansion of control mechanisms in the form of performance measurement has not achieved positive results. The integration of performance measurement systems with compliance regimes has generated perverse effects. The use of information from performance measurement systems by program managers at all levels is limited. Performance evidence is rarely used as the basis for new public policy decisions by elected officials. While performance evidence can inform budget decisions, there is room to debate the advisability of performance-based budgeting – rewarding the best performers with incremental resources or linking performance results and performance pay at the expense of rewarding collective efforts (Bourgon, 2008). After years of efforts, led by central agencies, to integrate performance measurement into planning, programming and budgeting there is little evidence that performance measurement has contributed to framing policy debate or improving Parliamentary oversight. When eventually some performance data enters the public domain, it is used for "bad stories", which immediately creates a chill for both political officials and administrators.

Separated from the political process, public debate and management decision-making, performance measurement is essentially an instrument of control and an expensive one at that. Growing numbers of indicators, increasing costs at the expense of results, unreasonable expectations, and limited use of performance information by decision-makers will eventually lead to course correction, thus running the risk of losing the positive aspects in the process. While the cost of performance measurement is certain, its benefits are tentative (Halachmi, 2005). Until such time that agencies are able to extract new insights from performance data and make better use of resources, efficiency will not be achieved.

Performance measurement is at its peak. If changes are not made, after 20 years of expansion, performance measurement is at risk of disappointing everyone and going into decline. There is no need to wait for that to happen. Instead, performance in government can be improved through the disentangling of performance management for better results from control

systems aimed at compliance. It is time to acknowledge that no system can credibly be all things to all people (Thomas, 2004).

The disentanglement would allow for the use of performance management as an instrument of innovation and improvement and not an instrument of control and compliance. Organizations become efficient and effective by being innovative, by improving processes, by taking calculated risks and by being responsive to environmental factors (Van Thiel and Leeuw, 2002). Innovation is about the management process of putting new ideas into effect, making them work in practice and overcoming the obstacles and resistances that are inevitably associated with steering change (Metcalfe, 1992). If more emphasis is placed on the regulatory aspect of performance management, it may discourage innovation and change in organizations. It can lead to a risk-averse environment, where public organizations are not able to think outside the box, be creative, flexible and responsive. This type of environment may lead to sacrificing creativity and innovation for regulation and accountability. While it can help inform the need for controls, a reasonable distance should be maintained between control mechanisms to ensure *compliance* and performance management systems to achieve better *results*.

Within limits, and in a stable, controllable and predictable environment, the regulatory approach to performance management and policy making can work well. "Where problems change little, policies remain stable, authority is clearly established, management capacities are adequate and policy implementation can be pre-programmed to a great extent, regulation is entirely appropriate" (Metcalfe, 1992, 10). Where these conditions are met, the most appropriate form of organisation is a classical hierarchical structure with a management-by-objectives style of leadership. But these conditions are not fully met today as public administration is a complex system in which interconnectedness, an increasing degree of interdependence, and a multiplicity of actors are the dominant features. In these circumstances, neither the policies nor the problems have the stability and predictability that makes a regulatory approach the appropriate management response to ensure effective performance. It offers too little scope for diversity, innovation and change in public sector organizations. It cannot accommodate various needs of different actors.

As Lee McCormack (2008) argues, "control is about stewardship of resources, applying restrictive rules only where they are justified, and promoting innovation to improve the efficiency and effectiveness of operations. Public sector control

restricts discretion in that it protects against unwanted events such as waste, lapses of probity, non-compliance with authority or fraud. When it is well designed and sensibly applied, control sets the context within which public administrators and politicians can test innovative ideas and improve performance for the benefit of citizens."

The separation of performance management from compliance regimes would have a significant impact on the performance of government. Compliance would be achieved through control systems and performance management would be used for better decision-making and improving results. As a result this system would be able to respond to the different needs such as: (i) the agency by addressing the needs of the managers and users of the services, (ii) the political system by addressing the needs of Ministers, elected officials and legislature, and (iii) society by addressing the need for accountability to the general public for good government and good governance in the country.

CONCLUDING THOUGHTS

This paper has argued that, while being mutually reinforcing, performance management systems and control systems serve different purposes and should have distinct identities. Control systems are about compliance to ensure and prevent risks of corruption, fraud, mismanagement, and misappropriation. Performance management systems are about the improvement of results, better decision-making, experimentation, learning, and innovation. Despite their differences, these two systems have become entangled, leading to a series of conceptual, motivational, and technical problems that serve to reduce the value of both systems. These problems are specific but not unique to the public sector. The disentanglement of control systems from performance management systems might be required to improve the performance of government.

Taking into consideration that the necessary disentanglement is a complex process that encompasses numerous factors, future research should focus on: (i) estimating the costs associated with the inclusive approach to performance management, and (ii) identifying the practical mechanism of how to disentangle performance management and control systems.

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LITERATURE SCAN #6:

Applications of Complex Adaptive Systems Theories in Governance, Public Administration and Public Policy

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Project Leader's Team

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SUMMARY

This paper provides an overview of key concepts in the literature on complex adaptive systems (CAS). It explores their potential relevance for public governance, administration and policy in the 21st century by reviewing a sample of studies that feature different applications of CAS theories.

Complex adaptive systems are seen to be *open systems* comprised of *positive and negative feedback loops operating over a range of temporal and spatial scales*, which makes behaviour in them *non-linear.* They are seen to be composed of *self-organizing agents* who strive to improve their *individual fitness* in a context in which *no central controlling mechanism* directs their behaviour. CAS exhibit *multiple, temporary, unstable equilibriums* and *limited predictability*. Order and regularity are seen as *emergent* characteristics; change in them can often appear *chaotic*. The appearance of functional group behaviours are seen to stem from a *limited set of simple, shared rules* that set the parameters for self-organization.

While some of these features of CAS may resonate for practitioners, the *effects* of CAS are likely to be much more familiar to them. These effects include *surprises*, *tipping points* and *cascading impacts* (Duit & Galaz 2008).

Some of the ideas from the CAS literature that may be helpful for NS6 network members and practitioners include:

- Acknowledge complexity, learn to distinguish it from the "merely" complicated, and use governance, policy and management approaches attuned to it;
- See government as one actor among many others, but as an actor with a pivotal role in influencing the behaviour of others towards desirable system outcomes;
- Embrace the power of self-organization but set-out the parameters for it with a limited number of smart, simple, clear rules;
- Harness the power of small changes that can produce large results but recognize that system behaviours can be unpredictable, outcomes are uncertain and constant course correction will be required;
- Know that both competition and collaboration and will be part of the dynamic of any complex endeavour;

- Connect with a wide array of other actors to gain knowledge of system behaviours and relationships to influence them;
- Learn to reframe public issues in affirmative ways that build on strengths, dissolves tensions and leads to action;
- Embrace diversity in roles, relationships and knowledge, as they provide the novelty and new energy that forms the basis for innovation, learning and change;
- Build capacities for both “exploration” and “exploitation” and maintain an appropriate balance of both;
- Explore the potential of multi-level governance arrangements in (i) managing the cross-scale interactions that characterize complex public issues and (ii) to buffer the negative effects of surprises, tipping points and cascading crises.

1. INTRODUCTION

Globalization, democratization, (post)industrialization, advances in information and communication technology, population growth and increased mobility have, among other developments, dramatically increased the density of connections, level of interdependence, and fragmentation of decision-making around much of the globe. While these forces of change have heralded in benefits for particular individuals, groups and regions, surprising new public problems continue to emerge in light of them.

For public officials, the direct impact of these forces has been an unprecedented level of complexity, uncertainty and unpredictability in the public issues they are tasked with managing; and these issues often extend across different levels (e.g., local, regional and national governments) and scales (e.g., time and space). As Andreas Duit and Victor Galaz (2008) observe:

> *Processes such as climate change, technological innovation, the spread of pandemic diseases, and rapid fluctuations in world markets all challenge a linear, scale-free, and static worldview…and do not add up in a linear predictable manner.*
>
> (311)

The range of public issues that emerge from these dynamic processes highlight the need for agile forms of government--and governance--that provide for anticipation, smart interventions, innovation and adaptation in a context of uncertainty.

One of the hypotheses driving the NS6 "new synthesis" project is that public administrators can learn from ideas about complexity and uncertainty that have been developed in disciplines not traditionally associated with their field and can potentially adapt this knowledge to help them achieve desirable outcomes for society. In this spirit of exploration, this paper provides a scan of some of the literature on complex adaptive systems (CAS), which represents one particular set of ideas about complexity. This paper should be read as a complement to the literature scans on complexity and resilience that were also produced as part of the NS6 project (NS6 Project Team 2009a, 2009b).

The purpose of this paper is i) to review key concepts and themes in the literature on CAS and ii) to explore their potential relevance for public administration in the 21st century. The paper begins with a primer on the key

features of CAS and the effects associated with them. It then provides a few examples of how researchers and scholars in public administration have been applying CAS concepts in their work. From there, the paper draws out some potential implications of the ideas of CAS for the field. It concludes with how these ideas may apply in the context of the NS6 project.

2. KEY FEATURES AND EFFECTS OF COMPLEX ADAPTIVE SYSTEMS

There is no generally agreed upon definition of what specifically comprises a CAS; however, a number of key features appear in the literature (Duit & Galaz 2008).

Complex adaptive systems, whether bio-physical or human-made, are seen to be dynamic, *open systems* that continually "exchange energy, matter or information with their environment" (Mitleton-Kelly 2005: 10). They are immersed in and comprised of an array of *positive and negative feedback loops*[28] *operating over a range of temporal and spatial scales* (Duit & Galaz 2008: 312; Holling 2001), which makes behaviour in them *non-linear*.[29] This means that "small changes do not necessarily produce small effects in other particular aspects of the system" (Duit & Galaz 2008: 312); they can have profound effects on the behaviour of the system as a whole (Anderson 1999; Buckley 2008).

Complex adaptive systems are seen to be composed of *self-organizing agents* (e.g., cells, species, social actors, firms, nations) who, in interacting with other agents, strive to improve their *individual fitness* in a context in which *no central controlling mechanism or agent* directs their behaviour (Drazin and Sandelands 1992; Duit & Galaz 2008: 313). Each agent is seen to have its own behavioural schemata or subroutines (Anderson 1999; Holland 2006), which are

[28] Negative feedback is understood as a change in one variable in a system leading to a change in the opposite direction in another variable in that system (e.g., more leads to less, less to more). Positive feedback is understood as a change in one variable leading to a change in the same direction by another variable (e.g., more leads to more, less to less) (Morgan 1997: 274). Positive and negative feedbacks can exist concurrently in system processes. In an economic example, strong demand generates high prices (a positive feedback relation); while high prices serve to weaken demand (a counteracting negative feedback relation) thereby producing lower prices (a predictable shift towards equilibrium) (Arthur 1990).

[29] The concept of feedback means "thinking about change in terms of loops rather than lines" and replacing concepts of mechanical causality (i.e., A causes B) with mutual causality, such that A and B "may be co-defined as a consequence of belonging to the same system of circular relations" (Morgan 1997:274).

"homemade" constructs through which they interpret their environments and build their strategies to deal with both familiar and novel situations. These schemata are altered through experience, but new schemata are based on past experience, making each agent's behaviour *path dependent* (Levinthal 1997).

In CAS, agents are unable to understand the entire system in which they are acting, and are unable to reliably forecast at the system level. They are seen to base their actions on locally available information and the actual or anticipated actions of other nearby agents (Levinthal and Warglien 1999). Based on an ongoing stream of "if/then" decisions, agents continually adapt their avenues of action, with each seeking to improve their "pay-off" (Anderson 1999; Holland 2005). However, because each individual's pay-off depends on the choices that other individuals make, agents are seen to *co-evolve* (Lewin, Long & Carroll 1999). Self organization and co-evolution continue as long as agents import novelty or new energy into the open system (Anderson 1999; Prigogine and Stengers 1984).

In striving to improve their own lot, agents' choices affect the adaptive landscape as a whole. The choices and actions of agents continually build and transform the context in which they interact. As a result of the constantly shifting behaviour of agents, the constantly changing relationships between them, and their continually shifting context, CAS exhibit *multiple, temporary, unstable equilibriums* and *limited predictability* (Dooley and Van deVen 1999; Duit & Galaz 2008). Order and regularity are seen as *emergent* characteristics and change can often appear *chaotic* (Anderson 1999).

The emergence of order in a CAS depends on the ability of agents to self organize, such that they can become "locked into self-reinforcing feedback cycles that lead to predictable behaviour" (Anderson 1999: 222), even if this predictability may be fleeting.

Finally, the appearance of functional group behaviours are seen to stem from a *limited set of simple, shared rules* that, on the one hand, are established and altered through self-organizing behaviours and, on the other hand, set the context in which self-organization can occur (Bovaird 2008).

While some of these features of CAS may resonate for practitioners in terms of their experiences, the *effects* of CAS are likely to be much more familiar to them. These effects include *surprises*, *tipping points* and *cascading impacts* (Duit & Galaz 2008).

Surprises stem from the extensive interconnectedness of actors and variables in CAS, the sum-total of which actors cannot readily grasp (Gibson, Clark & Ahn 2000; Gunderson and Holling 2002). These interconnected systems "contain poorly understood interactions driven by both positive and negative feedback processes operating over a range of spatial and temporal scales" and in which "system behaviour differs qualitatively from *a priori* expectations" (Duit & Galaz, 2008: 313). Some empirical examples include:

- Climate warming combining with agricultural runoff leading to a spread of bacteria that makes loss of water supplies permanent rather than sporadic;
- Animal-based viruses that surface in a local community, spread quickly and infect human populations;
- Financial crashes begin with local economic or political issues but are then triggered by external events (Duit & Galaz 2008).

Tipping points (Gladwell 2002)—or *thresholds* (Homer-Dixon 2007) *or gateway events* (Gell-Mann 1994)—describe abrupt changes that occur in CAS when a small event triggers much larger, qualitative changes in the system that are difficult or impossible to reverse. Some empirical examples include:

- Casual drug use that crosses a addiction threshold and leads to dependence (Gladwell 2002);
- Soil degradation that leads to permanent loss of agricultural productivity (Duit & Galaz 2008);
- Minor political disturbances leading to abrupt social change (Pierson 2003 cited in Duit & Galaz 2008).

Effects that stem from surprises and tipping points "have the potential to produce immense consequences for human welfare if they *cascade* across spatial scale (e.g., from local-regional-global), time scale (e.g., delayed impacts), and/or interrelated systems (e.g., from the technical to economic or political system)" (Duit & Galaz 2008, italics added). Examples include:

- Extreme weather events that have dramatic social and economic impacts (Moench and Dixit 2004 cited in Duit and Galaz 2008);
- A small, local failure in a transportation system or electricity grid cascades in unexpected ways across the entire system and causes

gridlocks and blackouts (Ellis 1998; Dobson, Carreras, Lynch & Newman 2007);

- Local production and consumption practices leading to overloading of carbon monoxide and other greenhouse gases in the atmosphere contributing to global warming leading to changes in climate leading to widespread negative impacts on natural, social and economic systems and the life chances of future generations (Senge, Smith, Kruschwitz, Laur & Schley 2008).

From these empirical examples, there seems to be enough evidence to support the further investigation of the potential applicability of CAS to governance and public administration.

As Tony Bovaird (2008) observes, the over-riding attraction of CAS theory is that it "holds promise of insights into those dynamic processes of change…which until now have only been imperfectly mapped and modeled in social systems" (320).

The next section reviews some of the public administration literature in order to see how researchers and scholars have been applying CAS, with a view to seeing how their work may help practitioners to better understand their roles in the face of complex, emergent public issues.

3. STUDYING GOVERNANCE, PUBLIC ADMINISTRATION AND PUBLIC POLICY WITH CAS CONCEPTS

Organizational theorists (e.g., Anderson 1999; Dooley 1997; Levinthal 1997; Morgan 1997; Stacey 1996, 2000) began adapting CAS concepts to their field in the late 1980s and early 1990s, arguing that such a perspective could develop useful analyses of complex organizational systems.[30] They were soon followed by a small group of researchers and scholars who view CAS theory as having "considerable potential as a framework for the development of required models in public administration", governance and public policy (Rhodes & MacKechnie

[30] Critics of applications of CAS concepts to organizations argue that CAS theories were not designed for analysis of organizations and that empirical validation of the theoretical claims in the organizational literature is required. Some organizational theorists admit "there is much to be done before CAS theory can be effectively applied in organizational contexts" (Rhodes & MacKechnie 2003).

2003: 58). A sample of this latter body of literature is reviewed here.[31] Each study features a different application of CAS theories, including:

- viewing ecological, social, economic and political systems as CAS that require new governance responses which are sensitive to CAS dynamics;
- analyzing public service systems as CAS in order to determine what levers might assist in moving these systems towards more desirable outcomes;
- considering public sector reforms and policy implementation processes as having features of CAS that require new strategy and planning approaches; and
- seeing certain public policy domains as having features of CAS and thus requiring new policy frameworks and interventions that are attuned to CAS dynamics.

3.1 GOVERNING COMPLEX ISSUES

Duit and Galaz (2008) explore the applicability and utility of incorporating CAS concepts into public governance theory to help inform how governments can address complex issues, such as sudden collapses in natural systems or cascading economic crises, that challenge their "steering capacity" (311). Duit and Galaz argue that many of the systems governments try to govern have CAS-like properties, and this has implications for how to design, implement and evaluate governance systems. In their view, the most important of these CAS-like properties is the emergent nature of behaviours in CAS and how sudden changes can occur in them through "cross-scale interaction effects" (317) (e.g., a problem that begins in one domain and location and cascades to other locations and domains). As a result, they set out to consider "how change is played out between governance systems on different scales [and] how different governance systems respond to complex adaptive change over time" (318). They point out

[31] A larger body of literature has also emerged since the early 1990s that applies CAS concepts to environmental and natural resource management and sustainable development. That literature was explored in a previous literature scan on resilience for the NS6 project and is therefore not addressed here (NS6 Project Leading Team 2009b).

> the main reason for this is not theoretical, but has to do with the behaviour characteristics of the systems that societies try to govern. Threshold behaviour and surprises in biophysical or technical systems might seem like marginal issues...[but]...this sort of nonlinear behaviour can spark off political crises that need to be dealt with in existing governance systems...[and]...such crises seldom confine themselves to a particular policy area (say health or energy) but tend to jump from one field to the other, unearthing issues and recombining them into unforeseen "mega-threats."
>
> (Duit & Galaz 2008)

Duit and Galaz (2008) observe that the "adaptive capacity" of governance systems incorporates the ability to "exploit" (i.e., to benefit from existing forms of collective action) and "explore" (i.e., to nurture learning and experimentation). Exploitation encompasses "refinement, choice, production, efficiency, selection, implementation, execution" (March 1991 cited in Duit & Galaz: 319). The fundamental problem is to find an exploitation system for collective action that is attuned to complex public problems. Force and hierarchy, third-party enforcement, institutional rules, generalized trust, institutional trust, network structures, and reciprocity represent different means for exploitation. The overall mix and strength of these mechanisms are seen to determine the governance system's capacity for exploitation.

Exploration encompasses "search, variation, risk taking, experimentation, play, flexibility, discovery, innovation" (Duit & Galaz 2008: 319). It involves gathering, analyzing, and accumulating information about ongoing developments. It also includes experimenting, testing, evaluating, refining, reapplying new governance practices, institutional configurations, and policies. 'Trial-and-error' approaches are viewed as helpful in dealing with uncertainty. In addition, an array of independent institutions, such as universities, think tanks, research institutes, arenas for public debate, science-policy dialogues, and an unbiased mass media, are seen as crucial to the explorative capacity of governance systems. Sufficient human, financial and physical resources are also required.

"Robust" governance systems will have strength and balance in both areas. In contrast, "flexible" systems with strong exploration abilities and weak exploitation abilities may mean that few adaptive benefits will be reaped; "rigid" governance systems with strong exploitation capabilities and weak exploration abilities will trap the governance system in a suboptimal state for adaptation; and "fragile" systems which have weak abilities in both areas may be caught in

"vicious cycles" (e.g., corruption, lawlessness, low social capital) which serve to further erode and weaken explorative and exploitative governance capacities (Duit & Galaz 2008: 322-324).

Duit and Galaz (2008) also observe multi-level governance arrangements, where different governance systems (based on different forms of authority) coexist and interact over a variety of societal, geographic and organizational scales and involve a wide range of actors, contribute to the adaptive governance capacities. These arrangements can serve to buffer negative effects and amplify desired effects stemming from CAS-like circumstances. For example, "rigid" national governance arrangements interacting with "flexible" local governance arrangements can incrementally produce comprehensive reforms at the national level.[32] Or, "rigid" national governance interacting with "fragile" local governance can amplify the effects of shocks or disturbances, such that national government is not flexible enough to respond to local impacts, and local government cannot deal with local impacts, and the problems reverberate throughout the whole governance systems and undermine legitimacy.[33]

Duit and Galaz (2008) conclude that a command and control model of instigating collective action is not tenable in the governance of CAS-like systems or phenomena. Rather, institutional stability and the ability to get—or "exploit"—collective action through other governance means is required, along with the ability to explore and to be flexible in order "to reduce vulnerability and secure vital resources of communities" (329).[34]

3.2 PUBLIC SERVICE SYSTEMS

Mary Lee Rhodes and Geoffrey MacKechnie (2003) observe that reforms and developments since the 1980s have resulted in increasingly complex public service systems. These systems "now encompass a broad range of public, private, and non-profit organizations that may work independently, in partnership, or even in conflict with one another to meet the needs of the

[32] The development of local markets and private firms in different parts of China has served to amplify the need for reforms at the national level (Tsai 2006 cited in Duit and Galaz 2008).

[33] The response to Hurricane Katrina is cited as an example (Duit and Galaz 2008).

[34] Duit and Galaz (2008) also argue the research agenda needs to shift from studying new governance models to elaborating the problem-solving capacity of multilevel governance systems.

consumers and/or citizens in their domain of operation" and feature "networks" as new actors (57). They rely on a diverse range of interactions among participants and the "social capital" that is developed through these interactions to generate public outcomes (58).

In light of the increased complexity of public service systems, Rhodes and MacKechnie (2003) describe the core elements of a CAS framework to help researchers and practitioners better understand such systems. Their goal is to be able to model the "observable and currently inexplicable behaviour of public service systems" in order to make more explicit connections "between system outcomes and agent behaviour" (81). Ideally, this would lead to "an improved understanding of the types of levers that might be applied at agent level to move the system towards desirable outcomes" (81), as has been done in other fields of study such as ecology (e.g., Gunderson & Hollings 2002) and economics (e.g, Krugman 1996).[35] To explore and validate elements of their model, Rhodes and MacKechnie (2003) apply them to a case, which allows them to validate and define three of the elements better and encourages them to press on with further research.

Of note in the article are the responses Rhodes and MacKechnie (2003) put forward to the self-imposed question of "what value does a CAS approach bring to either practitioners or theoreticians in public administration?"(74) They argue that a CAS approach to understanding public service would support the incorporation of adaptability measures into the implementation and evaluation of public policy interventions.[36] In this area, they argue "lower-level" (i.e., local) adaptation strategies are the best way to proceed; however, many public policy arrangements do not allow for this and thus do not produce anticipated outcomes or have negative unintended consequences. They also argue that CAS ideas can help practitioners and scholars better understand how to work in a public service context where i) order emerges out of self-organizing

[35] Much effort in complex adaptive systems studies has gone into computer modeling and simulation to try to find ways to discern complex elements and so manage interactions (Holland 2005, Holland 1994, Hubler and Pines 1994). In some senses, these are an extension of traditional thought experiments. This is a major development since computers can model situations and their outcomes much faster than humans can, and without the mental bias that humans may infuse into a simulation process (Holland 2005). Computer programs may also reveal likely emergent properties. Nonetheless, it is important to recognize that humans program these computer simulations and that "each step in a computer program must be explicitly specified, else the program will not execute as intended" (Holland 2005: 3). Therefore, there is a risk of bias or error in the initial programming that would affect the computer's findings.

[36] Rhodes and MacKechnie (2003) observe that adaptability and adaptive system dynamics are rarely considered in public policy interventions, despite the fact that the ability of agents to adapt to changing circumstances has been shown as crucial to performance of specific agents and complex systems as a whole.

behaviours, ii) there are few fixed points or stable equilibriums, iii) future developments depend on past conditions but predicting outcomes is difficult due to the novelty that can arise through interactions between many new actors, and iv) there are no simple levers available to intervene with predictable results, although complex behaviours and outcomes can arise from few and relatively simple rules and these behaviours may be shaped through a small set of behavioural rules.

3.3 STRATEGIC PUBLIC MANAGEMENT

In an article from 2008, Bovaird applies a conceptual framework for strategic management in the public domain that emphasizes "a strategic shaping and 'meta-planning' role" rather than conventional strategic planning. He argues this will help public managers to address the "restrictions on 'system predictability' in complex adaptive systems" (319).

He applies this conceptual lens to the "Best Value" initiative, which emerged in 1997 in the UK to improve local delivery of public services, and concludes

> the behaviours and strategies of agents owed as much to emergent complex interactions within the policy system as to the cognitive processes occurring in any one agency...[underlining]...the weaknesses of over-elaborate analysis of single agency interventions into public policy, strategy or governance within policy systems whose interactions are only partially understood.
>
> (319)

The framework Bovaird (2008) deploys includes some hypotheses that he explores and partially validates in his analysis of the Best Value initiative. For example, in terms of agents' behavours within the system, Bovaird predicted that "in a highly interactive system in which non-linear behaviours determine outcomes, system interactions are likely to be highly unpredictable" and agents will be unable to exercise as much control as they would like over events (326).

In the case study, he observed

- a network of many agents acting in parallel,

- highly dispersed control[37],
- many levels of organization with agents at one level serving as building blocks for agents at a higher level,
- constant revising and rearranging of building blocks through experience, and
- exploitation of the many niches in the system by agents adapted to fit them (330).

He also observed emergent behaviours and local level that aggregate through system and create new context.

In terms of the "system-changing" behaviours, Bovaird predicted that "emergent strategic management approaches are more likely to be successful than traditional strategic management" in altering the "rules of the game" in a CAS. He also predicted that "steering the overall system involves the encouragement of experimentation and an acceptance that top-down prescription is usually inappropriate or even unworkable" (326). In the case study, he observed how an initiative that began in a local context became subject to an elaborate superstructure (e.g., planning, reporting, inspections, audits) from central authorities that largely failed and was dismantled; yet, through all of this, the early intentions of the initiative were realized, due to a wide range of positive results from emergent, local behaviours. He also observed how system-level outcomes were largely influenced through local experimentation aimed a meeting local needs.[38]

Bovaird concludes that conventional understandings of strategic management needs to be reframed as the "set of actions by means of which an agent hopes both to make the most of recent changes in its environment…[and]…to change the longer term 'rules of the game' which shape how its environment evolves" (334). He recommends a "meta-planning" approach that "entails tracking how emerging situations offer the possibility of changing the 'opportunity map' facing the organization, and developing the capability of the organization to

[37] Bovaird (2008) observed that as interconnections among agents increased, so too did resistance to central control mechanisms.

[38] Bovaird notes that the central authorities he studied in the Best Value case have learned a lesson. Bginning in 2009, "instead of imposing the same (100+) targets for each local authority, in the new system each [local authority] will agree to thirty-five priority targets…allowing a much more differentiated approach across England…while still ensuring that central government's key priorities are met across the country as a whole" (338).

influence the overall system" instead of developing a "preferred set of strategic actions, with specific targets attached (338).

He also concludes that an important lesson to be learned from studying public administration from a CAS perspective is it "counsels us against placing too much confidence in deterministic models of economic, social and political behaviour" (339).

3.4 URBAN RENEWAL PROCESSES

In an article published in 2007, Rhodes and John Murray use a CAS lens[39] to provide a reading of urban renewal processes in Ireland. These processes consisted of activities such as demolishing and rebuilding apartments, relocating families, rerouting roads, constructing new community facilities, and tackling regional socioeconomic disadvantage. Their main area of interest is on how collaborative decision-making and shared implementation of decisions takes place in the public realm on these matters. Their specific interest is on how public managers work in these collaborative processes to achieve desirable public outcomes.

The CAS framework Rhodes and Murray use in their study emphasizes the complex interactions between agency, structure, environment (context) and public outcomes. In their findings, they report:

- the emergence of new agents that dramatically affected the "rules" and the outcomes (e.g., private firms creating a joint venture, local resident groups forming, existing local community groups expanding and changing focus);
- the appearance of adaptive strategies (e.g., the formation of subgroups to negotiate neighbourhood-specific variations with implementing agencies) which in some cases served to lessen the negative effects of uncertainty and complexity in the projects;

[39] Rhodes and Murray (2007) argue that CAS is a viable analytical perspective because it has the advantage of addressing systems that are composed of agent-based interaction, self-organization and are also capable of learning or adapting. They argue further that public management theory has been lacking a coherent treatment of the interdependencies between agent behaviour and systemic outcomes, and that CAS theory lays out an integrated framework that is capable of organizing a varied set of observations.

- Public sector agents playing a significant role in all cases, but with outcomes stemming from a complex mix of process, agents' behaviour and interactions as well as the initial public policy "intent";
- Frequent instances of non-linear behaviours in which the system of agents branched into qualitatively different states (e.g., sudden fracturing of relationships and local support) that would have been difficult to predict through *ex ante* analysis and planning.

They conclude that, in addressing complex phenomena like urban renewal, public management is "network management—a world of multiple agents with multiple objectives who must reach some operational consensus and co-alignment for a public…outcome to be delivered" (99). They observe the work of public managers in serving as "pivotal agents" in turbulent contexts such as these includes:

- Working within fixed rules (e.g., mandate, law);
- Maintaining policy direction;
- Facilitating agent collaboration and managing conflict;
- Fully engaging in definition of outputs and outcomes;
- Monitoring and intervening to shape and re-shape process and structures needed for achieving the mission (99).

3.5 HEALTH POLICY

In a discussion paper submitted in 2002 to the Commission on the Future of Health Care in Canada, Sholom Glouberman and Brenda Zimmerman (2002) look at reform of Canada's public healthcare system through the lens of CAS theory. They argue "health care systems are complex, and that repairing them is a complex problem…[however]…most attempts to intervene…treat them as if they were merely complicated" (vi). 'Rational', linear interventions (associated with solving complicated problems) can serve to erode the quality of health care and destabilize the health care system further. Instead, they argue "problems relating to health organizations and systems, health policy and health itself are complex rather than complicated problems that occur in the context of complex adaptive systems" (9).

While not every public policy issue is a complex matter, Glouberman and Zimmerman (2002) argue it is important to be able to distinguish the "merely" complicated from the complex because using "complicated interventions" to address complex issues can have negative, unintended consequences and vice versa. The provide guidance on how to distinguish complex from complicated problems, arguing:

> Simple problems like following a recipe encompass some basic issues of technique and terminology, but once these are mastered, following the recipe carries with it a very high assurance of success. Complicated problems contain subsets of simple problems but are not merely reducible to them. Their complicated nature is often related not only to the scale of the problem, like sending a rocket to the moon, but also to the issues of coordination or specialized expertise…Complex problems can encompass both complicated and simple subsidiary problems but are not reducible to either (Goodwin 1994) since they too have special requirements.
>
> (1)

The special features of complex problems include unique local conditions, high levels of interdependency, non-linearity, ambiguity and uncertainty of outcomes. All of these signal the need for an adaptive approach.

By way of example, the authors observe that raising a child is a complex problem: formulae (e.g., a "recipe" or "checklist") have limited application; raising one child successfully provides no assurance of success with the next child; expertise can contribute but is neither necessary nor sufficient to assure success; every child is unique and must be understood as an individual; uncertainty of outcome remains (Glouberman & Zimmerman 2002: 2).

In further unpacking the distinction between complicated and complex policy problems, Glouberman and Zimmerman (2002: 10) sketch out how theory, causality, evidence-bases, and planning should differ relative to them. Some of these are outlined in Table 1.

Table 1: Distinctions between Complex and Complicated Problems

	Complex	Complicated
Theory:	Non-linear (outputs not directly correlated with results)	Linear
	Opportunity seen in tension	Tension suppressed
	Solutions seen as internal to the system	Solutions seen as external to system
	Adaptation relative to a static context	Adaptation through interaction with dynamic environment
Causality:	Mutually influencing causes	Simple, linear causes
	Adaptive and emergent outcomes	Designed and intended outcomes
	Probabilistic	Deterministic
	Relationships and structures are interactive	Structures determine relationships
Evidence-base:	Holistic synthesis	Reductive analysis
	Outliers potentially significant	Averages central
	Functioning of actual relationships and feedback	Measures of efficiency, best practices
Planning:	Divergent thinking	Convergent thinking
	Decisions as emergent	Decisions as events
	"butterfly effect"	Big issues need big solutions

In the face of complex public issues, such as raising a child or reforming health care, Glouberman and Zimmerman (2002) argue "rational strategic planning models need to be rethought" (9). Policy interventions must dissolve rather than reinforce and exacerbate intractable tensions in the system. They must also consider "local conditions and...be aware of the uncertainty and feedback

that accompanies any intervention" (12). Some of the solutions they explore include:

- understanding that small interventions in CAS can have large effects—large scale, complicated interventions can destabilize the entire system, even if this is unintended consequence, while local, small, or incremental changes can have dramatic results;
- framing the issues in ways that build on strengths, focus on action, and dissolve tensions[40];
- focusing interventions on getting positive feedback loops going in the right direction (e.g., from vicious to virtuous cycles); and
- accepting that strategy is emergent process.

They pay particular attention to how better public policy outcomes can be achieved by reframing the issues in creative, affirmative ways. By way of concrete example, they provide a case study on Brazil's approach in combatting HIV/AIDs. They extract lessons about reframing issues from this case to make recommendations for the Canadian health care reform agenda.

There is not room here to summarize the Brazilian case study. Suffice it to say that in 1990 Brazil was in the midst of an HIV/AIDS epidemic—one of the worst in the world at the time. But because of the actions of many actors in Brazil, including government, the rate of infection has dropped to 0.6 percent. Glouberman and Zimmerman (2002: 18) attribute, in part, this remarkable achievement to the way Brazil reframed the problem.

For example, instead of asking "complicated questions" (recommended by the World Bank in 1997) such as "What will drug costs be for our infected population?" Brazil asked "How can we reduce costs so that we can provide treatment for all who need it?" A key policy response was to produce generic drugs, which meant successfully challenging the powerful pharmaceutical companies (who held the patents) through the World Trade Organization. Instead of asking the complicated questions "What infrastructure do we need to implement our plans? What will this cost? From what program/service will we take the money to afford this infrastructure?" Brazil asked "Where the informal

[40] This reframing is based in *appreciative inquiry* which moves beyond problem solving approaches that ask what policy gaps are there and how can they be filled towards a new line of questioning: what works, why, and how does one support that? (Zimmerman 2009). It is described as "a strength-based approach to change that induces innovation and collaboration through participatory methods" (Boyd & Bright 2006).

and formal networks/relationships that exist that are consistent with our overall approach and how can we strengthen these?"

The conclusions Brazil reached by reframing the issue with "complex questions" bear stark contrast to the conclusions reached by the "complicated questions" that were recommended to Brazil. These appear in Table 2, which is adapted from Glouberman and Zimmerman (2002: 18).

Table 2: Reframing Public Policy Issues – Case of Brazil and HIV/AIDS

Conclusions from "complicated questions"	Conclusions from "complex questions"
Meaningful solutions require sophisticated, integrated health care systems	We will find ways to use the resources we have to respond to the problem
We cannot provide treatment to all when the costs are so high—choices must be made	We will find a way to provide treatment to all who need it by dramatically reducing costs
We cannot afford resources to manage treatment	We will use our informal system to train people to care for themselves
With our limited resources, we should focus more on prevention than treatment	Prevention will be part of treatment and treatment will allow us "access" to population for prevention strategies

Glouberman and Zimmerman (2002: 22) apply a similar kind of logic to propose some "complex" questions to guide health care reform debate and action in Canada (see Table 3).

Table 3: Reframing Public Policy Issues – Canadian Health Care Reform

complicated questions	complex questions
What structures are needed to make the health care system sustainable?	How can we build on current structures and relationships to stabilize the system?
Is the system affordable, given the aging population?	How can we provide care that makes everyone feel the system will be there for them when they need it?
What trade-offs are required in order to afford the most effective and advanced treatments?	How can we help health care institutions and professionals enhance the quality of services and innovation?
How much should citizens pay for their health care?	How can a universal health care system contribute even more to the Canadian identity?

4. IMPLICATIONS OF CAS CONCEPTS FOR THE NS6 PROJECT

So, what does this scan of a sample of literature tell us?

It is clearly very early days in the adaptation of CAS theories to public administration. The authors are engaged in a search process. They are selecting different concepts, reinterpreting and developing them, and trying them out as lenses through which to "read" complex public governance and management issues and processes. It is still not clear which, if any, CAS concepts will 'make the cut' and which will be jettisoned.

In general, the discussion is still very theoretical and the terminology is highly specialized. Future applications of CAS will likely require a more practical focus couched in language that more accessible for practitioners. That being said, it is arguable that practitioners are already doing many things that resemble the theoretical propositions flowing from adaptations of CAS theories to public

administration and governance; they are just doing them under different names. For example, "self-organization" might appear in practice as "empowering others", "shared governance", "co-management" or "self-regulation". The idea of "simple rules" might appear as "framework legislation". There is not room here, but it might be a useful exercise at some point to cross-walk existing practices to the key concepts in CAS theories to see how much, or how little, practitioners already have in their complexity toolkit.

Despite being in early days, a number of helpful ideas can be gleaned from the CAS literature scanned here that may provide guidance for the NS6 project and, potentially, practitioners. These include:

- Acknowledge complexity, learn to distinguish it from the "merely" complicated, and use governance, policy and management approaches attuned to it;
- See government as one actor among many others, but as an actor with a pivotal role in influencing the behaviour of others towards desirable system outcomes (i.e., public results and the public good) and with fundamental stewardship responsibilities;
- Embrace the power of self-organization but set-out the parameters for it with a limited number of smart, simple, clear rules;
- Harness the power of small changes that can produce large results but recognize that system behaviours can be unpredictable, outcomes are uncertain and constant course correction and emergent strategies will be required;
- Know that both competition and collaboration and will be part of the dynamic of any complex endeavour;[41]
- Connect with a wide array of other actors to gain knowledge of system behaviours and relationships to influence them, but recognize

[41] Communication and cooperation, in human systems, introduces the age-old problems of free-riding, tragedy of the commons for public goods and the conflict between individual and collective fitness and pay-off. This is especially problematic since the marginal return of co-operation decreases as agents get closer to their social optimum (Levinthal and Warglien 1999). Game theory and the behavioural sciences have begun to tackle the individual versus communal question. Game theory tends to favour private incentives, while behaviour sciences indicate that cooperative acts in one period elicit greater cooperation in subsequent periods (Ostrom 1992). Levinthal and Warglien suggest that large-scale cooperation is "more likely to be induced as the aggregation of cooperation within smaller groups" (352).

that the capacity for independent action forms part of the adaptive strengths of the system;[42]

- Learn to reframe public issues in affirmative ways that build on strengths, dissolves tensions and leads to action—do this with others!
- Embrace diversity in roles, relationships and knowledge, as they provide the novelty and new energy that forms the basis for innovation, learning and change;
- Build capacities for both "exploration" and "exploitation" and maintain an appropriate balance of both;
- Explore the potential of multi-level governance arrangements in (i) managing the cross-scale interactions that characterize complex public issues and (ii) to buffer the negative effects of surprises, tipping points and cascading crises.

5. CONCLUDING THOUGHTS

The findings in this paper suggest that government cannot perceive itself as an external actor independently regulating public issues, but must be prepared to collaborate with other actors in a Complex Adaptive System of governance. Additionally, the evidence suggests it is essential for government to foster a dynamic climate of exploration, experimentation and innovation in order to quickly recognise emerging trends and developments and to manage these better on a case by case basis. Ultimately, a governance perspective which utilizes concepts from CAS may be an important addition to the public servant's toolkit when traditional, causal analysis is not suitable.

21st century governance is characterized by the following observable characteristics: an open system; nonlinearity; thresholds; feedback effects; multiple agents with multiple interactions; agent decisions based on these interactions and their contexts; observable self-organisation among agents (especially when not initiated by a central command); observable co-evolution. Therefore, it is a useful analytical exercise for public administrators to conceive

[42] "The diversity and independence of firms in the marketplace and of groups in civil society let Western societies explore their fitness landscapes rapidly and continuously" (Homer-Dixon 2001, 307).

themselves as agents within this system of governance and learn principles to help them steer the system towards optimal outcomes for society.

Today's unparalleled complexity is anchored in multi-agent interaction, and is perpetuated by modernisation and globalisation factors such as information and communication technologies, international markets and trade, and easier global mobility. Ideas from complex adaptive systems literature are increasingly relevant as public managers realize that conventional approaches to government exclusively focused on centralised command and control may no longer prove sufficient in achieving desirable public outcomes.

Nonetheless, abandonment of government control and the stewardship role of government is also not the appropriate response. What may now be required is a reassessment of the role of government given new circumstances and an understanding of complex adaptive systems. Certainly, some modern problems remain best organised along conventional methods of governance. For example, the necessity of a clear command structure in fields such as National Security remains fundamentally important. However, even within the field of counterterrorism, measures are now being designed to include new stakeholders and perspectives to account for complexity and uncertainty. Other modern challenges, such as climate change and food security, will require collaboration and cooperation beyond this traditional structure.

Governments hold the credibility and legitimacy to shape events and issues. Thus, while different agents will act, innovate and adapt to improve their own lot as they see fit, governments are in the best position to set parameters for these behaviours. Representative and responsible governments have the best capacity to ascertain the underlying values required to set these parameters as well as the capacity to communicate their version of parameters to other governments. If governments accept this position of facilitating, steering, course correcting as well as recognising their position as one agent among many, they may better adapt to the complex relations, problems and solutions that are inherent characteristics of the modern world.

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