

Issues Paper No 4.
*How can systems thinking
enhance stewardship of
public services?*

ISSN 2652-5305

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EXECUTIVE SUMMARY

Much has been written about systems thinking and its potential application in public administration. However, to date there is no clear consensus about its key concepts or methods, and very little empirical evidence exists to guide system level stewardship practice for those working in government. In this paper we review and synthesise the literature to first provide an overview of core systems ideas and theory. Second, we propose a practical application of systems thinking in four key areas of stewardship which may assist people working within and with government to deliver public policy outcomes in complex and dynamic service environments. In doing this we address the key question: how can governments and others design, deliver and evaluate effective policy and manage risk in complex and dynamic environments?

First we propose that stewardship needs to incorporate a focus on supporting cooperation among stakeholders if it is to achieve outcomes. Departments can apply policy levers to foster cooperation among actors within and interacting with service systems so that people can navigate the service system seamlessly and with confidence. Such a role involves designing and delivering policy under individual departments' purview, and also contributing to a service system that can work in concert across jurisdictions and sectors to achieve shared goals.

Second, we suggest it is important to understand the implications of different types of complexity in public service delivery. We apply the current policy literature to demonstrate how different types of complexity can impact on compounding marginalisation and increasing disadvantage, and policy activities that might be undertaken to address these.

Third, we argue that a systems approach encourages clarification of policy goals at multiple system levels and builds in capacity for learning and improvement. This involves a shift away from existing information structures and flows to a system that supports the collection and use of data across multiple jurisdictions to improve service and to understand and monitor changes in market conditions, client outcomes, and public benefit. We offer an employment services example that highlights how different types of de-identified data might be disaggregated and used at different levels of the system from micro to macro to interrogate and achieve different policy questions and goals.

Fourth, a systems approach forces a reconsideration of individualised incentives and support for collective action solutions and partnerships. A key weakness in the institutional architecture of many systems engaged in delivering public services to common groups of citizens is the lack of an incentive framework to act outside achieving individual program and organisational key performance indicators. Addressing policy issues like long-term unemployment, social and economic inclusion for people with disabilities, health or environmental issues calls for a coherent funding and performance measurement regime that rewards collective-action solutions and partnerships between services across jurisdictions to participate meaningfully in the community.

INTRODUCTION

Why systems thinking and why does it matter?

Many of the most pressing policy challenges for the APS involve dealing with very complex problems. These problems share a range of characteristics—they go beyond the capacity of any one organisation to understand and respond to, and there is often disagreement about the causes of the problems and the best way to tackle them. These complex policy problems are sometimes called ‘wicked’ problems.

Australian Public Service Commission's (APSC) *Tackling wicked problems: A public policy perspective*: <https://www.apsc.gov.au/tackling-wicked-problems-public-policy-perspective>

There is growing interest in how systems thinking approaches might be applied to public administration to help policy makers and others better steward and manage public services to overcome complex, multi-layered problems. It is now well recognised that public policies often fail to achieve their intended results because of the complexity of both the environment in which policy and program implementation takes place, and the policy-making process itself.

Government portfolios, funding mechanisms, measurement processes and areas of responsibility have promoted siloed ways of working, yet complex problems have multiple causes and span different areas of program responsibility. Silos do not just affect how programs operate, they drive how interventions are designed, how information is shared and how impact is measured. If something is outside of the control of any single silo, there is a tendency to omit it from modelling and policy thinking.

New ways of working that allow governments and their agents to effectively influence and steward systems from which outcomes emerge, and to capture the full costs and benefits of policy decisions, are needed. The key question is: how can governments and others design, deliver and evaluate effective policy and manage risk in complex and dynamic environments?

While much has been written about systems thinking and its potential application in public administration, there is no clear consensus about its key concepts or methods and very little empirical evidence exists to guide stewardship practice.

Stewardship is considered an important driver of contemporary public service practice, central to reform and the delivery of human services, particularly in relation to managing public service markets in resource constrained environments (Productivity Commission 2017). Stewards assume responsibility for influencing actors and allocating resources so that private value can be leveraged for public good. They ensure accountability for implementation of high quality, user-driven service delivery models that produce outcomes for populations and individuals. However, the means by which stewardship can be practiced to achieve such outcomes remains poorly understood (Moon, Marsh et al. 2017).

In this issues paper we propose a practical application of systems thinking to stewardship practice. We begin by reviewing the literature (see Appendix 1 for details of the methods used) to explore the notion of systems thinking and the key concepts and methods its proponents advocate. We consider what the literature can bring to the task of stewarding public services to help governments meet the needs of citizens in an increasingly complex, interconnected, and globalized environment. We find that much of the systems thinking literature remains highly conceptual, so we synthesise key lessons and offer examples to illustrate potential applications in stewardship processes.

WHAT IS SYSTEMS THINKING?

Many different definitions of systems thinking can be found throughout the systems community, and the term has been defined and redefined in different ways since it was first coined by Barry Richmond in 1987. Concerned with what he described as a growing web of dynamic interdependencies that were giving rise to increasingly complex and difficult problems in a globalising world, Richmond saw an increasing gap between the nature of problems and people's capacity to understand and solve them (Richmond, 1994). He argued for new ways to understand the underlying roots of complex problems and behaviours in order to better predict and ultimately to alter and reshape their impacts and outcomes. Systems thinking, *"the art and science of making reliable inferences about behaviour by developing an increasingly deep understanding of underlying structure"* (see Arnold, 2015, p.671), is manifestly concerned with the behaviour of systems and how elements within them interact to give rise to various outcomes.

Senge (1991, p.683) described systems thinking as "a discipline for seeing wholes and a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots." Systems thinkers emphasize the dynamic, often unpredictable, interactions among diverse, and constantly adapting parts of a whole system. They study patterns of connection between components that give rise to larger wholes, not just the component parts themselves. Patterns of connection are more often web-like than linear and systems cannot be reduced to their individual parts, since the interaction of the elements produces outcomes that are greater than the sum of the parts themselves. Braithwaite, Churrua et al. (2017, p.5) note,

Reducing a system to its component parts is like inspecting the legs, body, neck and head separately and expecting to understand how a giraffe works. Instead of pursuing such reductionism, complexity scientists aim to study the properties and characteristics of the system.

Taking a systems thinking approach challenges mechanistic assumptions of causality, moving beyond reductionism to more nuanced notions of cause and effect (Chapman, 2004). By exploring the connections between elements, and giving the connections equal status to elements, systems thinking focuses on understanding the inter-relationships, interactions and system boundaries that give rise to, and at the same time constrain or enable, possibilities for action and change (Abercrombie, Harries & Wharton 2015; Johnston, Matteson & Finegood 2014).

In focusing on connections, systems thinking reframes how problems are understood and addressed, and how people and resources are engaged in such processes. While there are different approaches to systems thinking and it remains a rather loose collection of analytical perspectives, there are consistent themes around connection, shared responsibility, and the importance of context. Normative examples that illustrate key differences between systems and conventional thinking have been developed by a number of different organisations. An example from the Australian Prevention Partnership identifying differences in the way problems are identified and resolved is shown in Table 1 (Australian Partnership Prevention Centre 2019 p.3).

Table 1: Conventional thinking and systems thinking

	Conventional thinking	Systems thinking
How a problem is explored	Isolate parts to understand behaviour	Explore emergent nature of the system as a whole
Goal	Create a solution to solve the problem	Deepen understanding of the system and identify a response to test
Nature of the problem	Can be defined and isolated, with a clear cause and a solution. Problems can be understood objectively	A situation has multiple causes, with no clear single solution. Wicked problems are understood differently depending on perspective
Who is responsible for the solution?	External/others	Everyone is a part of the system and therefore needs to engage in change
How solutions are achieved	Multiple short term success leads to long term solutions	Most action has unintended consequences. Need to test, seek feedback and adapt responses
How the problem can be solved	Improve parts to improve whole	Improve whole through improving relationships between parts
Problem solving process	Linear process with clear steps, start and finish	Multiple entry points, non-linear process focused on learning and iterating

Adapted from: Ison, R. 2010. *Systems Practice: How to Act in a Climate-Change World*.

Such understandings point to fundamental conceptual difficulties in applying traditional notions of planning, monitoring and evaluating policy and program interventions. Although complexity-aware approaches are gaining strength, there is still little empirical evidence of what it takes to implement them in practice. This raises difficult questions, not least, the extent to which policy makers can be held accountable for policy outcomes when these depend on interactions among so many actors, ideas and structures in complex systems. How should they go about understanding their role in relation to implementation of policy and how best can they do it in circumstances where there may be limited opportunities for shaping interactions?

Early proponents of systems thinking (see for example de Greene, 1993) argued that all people in decision-making roles should have a solid grasp on systems thinking since it was seen as providing the theoretical and practical tools for seeking solutions to messy social and organisational problems at multiple levels of scale. Recent thinkers advocate a more nuanced approach. Crowley, Stewart et al. (forthcoming 2020) for example, advocate the use of systems thinking as a way of expanding our understanding of the relationships through which policies achieve their effects. This includes what has been proposed by Cairney, Heikkila and Wood (2019), that systems thinking helps with describing and modelling complex systems and understanding outcomes of real world events including their unintended consequences and adverse events, potentially changing the way that policy problems are perceived and acted upon.

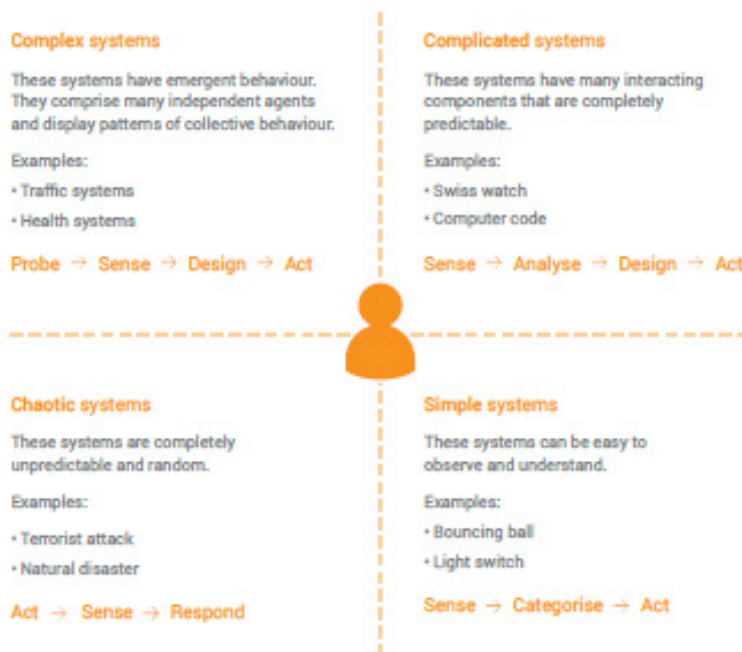
PROPERTIES OF COMPLEX SYSTEMS

Meadows (2009) suggests that a system is a set of organized related components that work together in a particular environment to perform whatever functions are required to achieve the system's objective. A system is delineated by its spatial and temporal boundaries, and is surrounded and influenced by its environment. One way to recognise a system is to describe its purpose and the way the structure supports that.

The Cynefin model (Box 1), a widely recognised model for classifying systems, posits the existence of four types of systems: complex; complicated; chaotic and simple (Snowden and Boone 2007).

Box 1: The Cynefin model

- Complex
- Complicated
- Chaotic
- Simple



Unlike simple systems which are easily observable, or complicated systems which are predictable despite having many interacting parts, complex systems comprise many independent agents with strong connections among them. Changing events in one part of the system will influence the probability of events emerging in another. Complex systems cannot be controlled by any one person or organisation and actors cannot reasonably be expected to know the full causes of their situation or the consequences of their actions. Because complex systems are non-linear, solutions emerge over time and require ongoing exploration and feedback to inform actions. This is why the approach to working in complex systems as outlined in the Cynefin model is to 'Probe-Sense-Design-Act'. Systems thinking resonates closely with such an approach.

Despite dynamism and uncertainty associated with predicting and controlling outcomes, complex systems have common properties as outlined in Box 2 below.

Complex systems are greater than the sum of their parts: Parts interact, share information, combine and recombine to produce systemic behaviour

Flux: Neither the system nor its external environment are constant

Individuals within a system are independent and creative decision makers

Uncertainty and paradox are inherent within any system. Problems that cannot be solved can nevertheless be "moved forward". Effective solutions can emerge from minimum specification

Opportunities for leverage: Small changes can have big effects

Attractors: Behaviour exhibits patterns, termed attractors. Change is more easily adopted when it taps into attractor patterns

Emergence: larger things emerge from smaller parts

Emergent behaviours: Behavioural patterns can change quickly accelerated by behaviours not part of the original design

Interconnectedness: Systems thinking requires a shift in mindset, away from linear to circular.

Feedback loops: Since everything is interconnected, there are constant feedback loops and flows between elements of a system. We can observe, understand, and intervene in feedback loops once we understand their type and dynamics.

Path Dependency: It is difficult to change established practice and time will be needed to reconcile new with old arrangements. Changes that contradict lessons from the past will be most resisted

Tipping points: Systems can be about to undergo a period change which may or may not be obvious to observers

Causality: as a concept is about being able to decipher the way things influence each other in a system. Understanding causality leads to a deeper perspective on agency, feedback loops, connections and relationships, which are all fundamental parts of systems mapping.

Synthesis: As opposed to analysis, which is the dissection of complexity into manageable components and fits within a mechanical and reductionist worldview, synthesis is about understanding the whole and the parts at the same time, along with the relationships and the connections that make up the dynamics of the whole.

Four types of complexity can present in complex systems (French and Lowe 2018):

- **Compositional complexity**, which results from the interdependence and inter-determinance of causal factors leading to the creation of outcomes
- **Dynamic complexity**, which results from the coevolution of interacting factors and the instability inherent to complex systems over time
- **Experiential complexity**, which results from the variation in how outcomes are experienced by individuals, and the multiplicity of pathways to shared outcomes across the population
- **Governance complexity**, which results from the autonomy of public service organisations and other agents, increased by the fragmentation of modern public service landscapes. It extends to the individual governance arrangements within organisations.

Of note for those developing or implementing policy is that wicked problems (APSC, 2007) can be seen to exhibit this range of complexity as they are: difficult to clearly define (governance complexity); rarely stable or linear (dynamic complexity); involve changing individual behaviour (experiential complexity); and have many interdependencies and are often both socially complex and multi-causal (compositional complexity). Attempting to address problems of this type often leads to unintended consequences.

SYSTEMS METHODOLOGIES AND POLICY TOOLS

The focus on dynamism and uncertainty in complex systems draws researchers away from traditional linear methods and the use of grand theory in understanding change processes (Cairney, Heikkila & Wood 2019). Greenhalgh and Papoutsis (2018, p2) explain:

Because the system is dynamic (turbulent, even), the conventional scientific quest for certainty, predictability and linear causality must be augmented by the study of how we can best deal with uncertainty, unpredictability and generative causality. For this, we need research designs and methods that foreground dynamic interactions and emergence – most notably, in-depth, mixed-method case studies that can act as concrete, context-dependent exemplars, including powerful ethnographic narratives paying attention to interconnectedness and incorporating an understanding of how systems come together as a whole from different perspectives.

The most advanced systems methodologies seek to model systems and/or subsystems to identify potential leverage points for intervening in a system to create change (Carey, Malbon et al. 2015). Hard systems methodologies produce quantitative dynamic models to examine system dynamics. Soft system methodologies emphasise the contingent nature of policy making and problem definition, and focus on the human activity side of systems (Checkland & Scholes, 1999). They draw on qualitative action-based research and case study analyses, often focused on understanding change processes or innovation.

The most common systems methodologies include: systems mapping, systems dynamics, network analysis, agent-based modelling, system effects, action-based research and case studies. Table 2 contains a description of systems methods outlining examples of their application and contribution to knowledge.

Table 2: Systems methodologies

Type of approach	Contribution	Examples
System mapping	Compared with linear ways of understanding the impacts of interventions such as program logic models, which suggest inputs lead invariably to outputs and outcomes, systems maps provide a closer version of what happens in reality	Lee et al. 2016
System dynamics	Uses a formal structure to provide an understanding the non-linear behaviour of complex systems over time using stocks, flows, internal feedback loops, table functions and time delays.	Von Loeper, Musango et al. 2016; Wheat 2010
Network analysis	Network analysis can be used to investigate the structures of complex systems using tools from graph theory It characterizes systems in terms of <i>nodes</i> (individual actors, people, or things within the network) and the <i>ties, edges, or links</i> (relationships or interactions) that connect them.	McGlashan, Johnstone et al. 2016; McGlashan, de la Haye et al. 2019; Considine and Lewis 2007; Lewis 2010
Agent-based modelling	An agent-based model (ABM) is a class of computational models for simulating the actions and interactions of autonomous agents (both individual or collective entities such as organisations or groups) with a view to assessing their effects on the system as a whole.	Polhill, Sutherland et al. 2010; Dobbie Schreckenberget al 2018

System Effects	The System Effects methodology emphasises the varied nature of social phenomena, their causes and consequences, while at the same time giving policymakers tools to understand the complex nature of how those varied factors manifest at the community — or population — level. System Effects can be used to support the design, implementation and evaluation of interventions aimed at changing the structure of complex adaptive systems to drive particular outcomes. By beginning from the ‘user’ understanding of complex systems, the methodology helps to re-centre lived experience in social science and policymaking practice.	Craven 2017; Roesel et al. 2018
Case studies	Case studies explore contemporary phenomenon within their real life contexts, especially when the boundaries between the phenomenon and the context are not clearly evident	Greenhalgh 2018; Gardner 2010

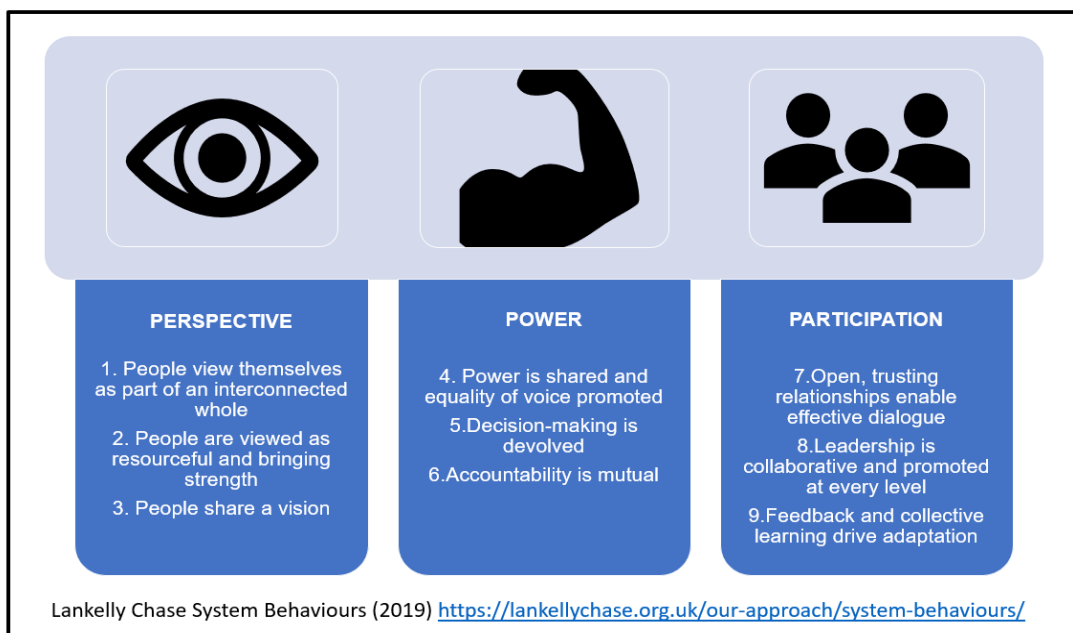
Some authors advocate a shift away from theory toward tools to guide policy action. Adopting an action focus is critical to many systems thinkers. Price, Haynes et al. (2015) for example developed the Brighton Complex Systems Toolkit containing 7 key tools for policy makers. These are outlined in Box 3.

Box 3: The Brighton Complex Systems Toolkit

1. Identify the properties and members of the system
2. Think of leadership as the actions of many people, not just a CEO
3. Encourage a sense of self-organisation in systems rather than seeking top-down control
4. Accept that people must use short cuts to gather information and make decisions
5. Develop appropriate ways to scan for information
6. Experiment with policy interventions rather than seeing policy as key events
7. Evaluate policies regularly to ‘do more of what works and less of what doesn’t

In a similar vein, the Lankelly Chase Foundation in the UK has identified common qualities in systems that they suggest are effective in responding to severe and multiple disadvantage (See Box 4). They argue that perspective, power and participation, rather than any specific methodology, are the keys to addressing complex policy problems (Lankelly Chase, 2019), a view consistent with other models of systems thinking.

Box 4: Lankelly Chase System Behaviours



The focus on change is paramount for systems thinkers. A key principle is that change can be achieved through identifying leverage points or as Meadows (2009) puts it, places in systems where small changes could lead to large shifts in behaviour. She identifies 12 main places to intervene in a system (Box 5).

Box 5: System levers

PLACES TO INTERVENE IN A SYSTEM - (in increasing order of effectiveness)

12. Constants, parameters, numbers (such as subsidies, taxes, standards).
11. The sizes of buffers and other stabilizing stocks, relative to their flows.
10. The structure of material stocks and flows (such as transport networks, population age structures).
9. The lengths of delays, relative to the rate of system change.
8. The strength of negative feedback loops, relative to the impacts they are trying to correct against.
7. The gain around driving positive feedback loops.
6. The structure of information flows (who does and does not have access to information).
5. The rules of the system (such as incentives, punishments, constraints).
4. The power to add, change, evolve, or self-organize system structure.
3. The goals of the system.
2. The mindset or paradigm out of which the system — its goals, structure, rules, delays, parameters — arises.
1. The power to transcend paradigms

<http://donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/>

In terms of designing successful stewardship interventions in complex systems it is of note that the interventions most likely to create real change are reconceptualisations of the goals, structure and rules; creating new ways of working (paradigms) or seriously changing the power differentials. As we apply this in the next section the reasoning behind using a system lens to create alternative ways of delivering public service becomes apparent if there is to be real change - for example, some current approaches in Indigenous affairs seek to change the power distribution across the system.

HOW HAS SYSTEMS THINKING BEEN APPLIED TO STEWARDSHIP OF PUBLIC SERVICES?

A large body of literature applying systems thinking to stewardship and policy processes has sought to reconceptualise the nature of policy processes themselves, and to better understand how change happens in complex systems and how change and improvement might best be supported. Contributions fall largely into three areas (see Appendix 2 for example papers)

- Reconceptualising policy and systems issues using systems theory and methods
- Modelling aspects of systems such as interrelationships, self-organisation, or resilience
- Consideration of new ways to govern and evaluate public services

The first area covers a wide range of issues and themes. Studies include those aimed at reconceptualising public organisations and policy processes; to those that rethink public sector activities such as management, planning and collaboration; and to reconceptualisations of pressing current policy problems like intimate partner violence.

In the second area, dynamic simulations, and the use of other system modelling techniques have focused on understanding the resilience of socio-ecological systems; and causal pathways in complex systems, with applications in topic areas such as supply chain management and performance management.

The third area focuses on the governance of public services and the ways in which accountability and management might play out in complex systems.

Much of this work is in its infancy and our review found that the most significant research effort is being invested into new ways of *seeing and understanding* policy problems, trialling methods that might be used to investigate policy relations and processes, and identifying impacts and outcomes that emerge at different levels. To a large extent this has not translated into practical help for policy makers attempting to steward complex systems in ways that systems thinking advocates inspire. Carey, Malbon et al. (2015, p.7) describe this as follows:

making a system-dynamics model does not give policymakers agency in spaces where they currently have none. Public health problems are already deemed complex, and systems-based approaches can contribute to changing the language, methods and methodologies for conceptualising and acting within this complexity.

The extent to which systems thinking can really deliver on its promise for change remains uncertain. Although it encourages a move away from rigid governmental hierarchies, top-down policymaking, centrally driven targets and performance indicators, based on the idea that policymaking can be controlled and policymakers can impose order (Cairney, Heikkila & Wood, 2019), few studies explore how this can be done in practice. Authors routinely comment that doing policy through a systems lens involves looking for ways to influence, negotiate and lead rather than to manage, control and command. From this perspective stewards are recommended to pay close attention to system changes, actively engage at all times as the system moves and respond to feedback; in other words as Meadows (2009, p165) would advocate: “dance with the system”.

As Bridgman and Davis (2007, p 90) remind us however, “A policy idea means nothing if it cannot be converted into practical application”.

Moving to the kind of consensus based model of stewardship practice that emphasises relationship building, collaboration and information sharing, might at times seem more rhetorical than realistic in the context of market based public services where public, private and non-government providers operate in vastly different contexts with values, practices and business strategies that reflect these. A key challenge

here is that individual actors in such systems have different drivers and different levels of tolerance for risk. It is reasonable to assume that private firms deliver public services and support on behalf of governments to serve the best interests of their shareholders, not to maximise the public good. From their perspective, sharing information, networks, power and resources may not be in their best interest. Similarly, it is also reasonable to assume that not-for-profit organisations may not willingly share their information, networks, power and resources with private firms seeking commercial gain from that exchange. Such systems require careful stewardship and astute use of data and policy levers.

WHERE NEXT FOR SYSTEMS THINKING IF IT IS TO HELP POLICY MAKERS STEWARD PUBLIC SERVICES?

It is our contention that systems thinking must engage to a greater degree with the realities of policy making processes if it is to deliver greater practical benefits for public servants charged with stewarding real world systems to leverage change.

When we apply systems thinking Crowley, Stewart et al. (forthcoming) encourage us to think about:

- context, the political and institutional setting of the policy in question;
- scope – what’s in, what’s out; who is in, who is out?
- actors (both stakeholders and organisations);
- interconnections between actors (flows of information, money and influence);
- inter-connection between systems – problems observed in one system may be caused by developments in another;
- the ways in which actors change systems (complex adaptive systems) and what this may mean for policy intentions;
- feedback, and its implications for regulatory controls; and
- the nature of change itself, because systems are interacting constantly both with themselves and with their environment.

Policy makers use policy instruments to steward public services. These instruments incorporate both the methods used to achieve policy objectives and the tools and mechanisms applied to implement policy. Althaus, Bridgman and Davis (2018, p105-106) describe seven types of policy instruments used in Australia, as shown in Table 3. These are key leverage points through which changes can be made.

Table 3: Policy instruments (Althaus, Bridgman & Davis 2018: p105-106)

ADVOCACY	Educating or persuading, using information available to government
NETWORKING	Building and leveraging relationships within and across government and with external partners to develop desired behaviours and goals
MONEY	Tax and spending to shape activity
DIRECT GOVERNMENT ACTION	Delivering services through government agencies
LAW	Legislation, regulation, use of authority
BEHAVIOURAL ECONOMICS	Using psychological principles to 'nudge' people to shift their behaviour to meet policy directions
NARRATIVE	Framing policy in evocative and/or emotional ways that lead people to perceive it in a particular way

Taking account of these policy leverage points, applying lessons from the systems thinking literature and drawing on our research, we suggest 4 key action areas to enhance the research and practice of stewardship in complex policy environments:

1. Foster cooperation among stakeholders to steward systems to achieve outcomes

In terms of *stewardship*, departments can apply policy levers to foster cooperation among actors within and interacting with service systems so that people can navigate the system seamlessly and with confidence.

Such a role involves designing and delivering policy under individual department’s purview, and also contributing to a service system that can work in concert across jurisdictions and sectors to achieve shared goals. As the Productivity Commission (2017, p. 85) describes:

Government’s stewardship role involves making sure that those providers that are best placed to achieve outcomes are in a position to do so. Good stewardship should ensure that the only barriers to entering (and exiting) a market are those necessary to ensure positive outcomes for users and the overall effectiveness of service provision.

2. Understand the implications of different types of complexity in public service design and delivery

The four types of complexity identified by French and Lowe (2018), referred to earlier in this paper, are not mutually exclusive. They flag where government should consider the implications of policy decisions and action from different perspectives.

Table 4: Implications of different types of complexity in stewardship of public services

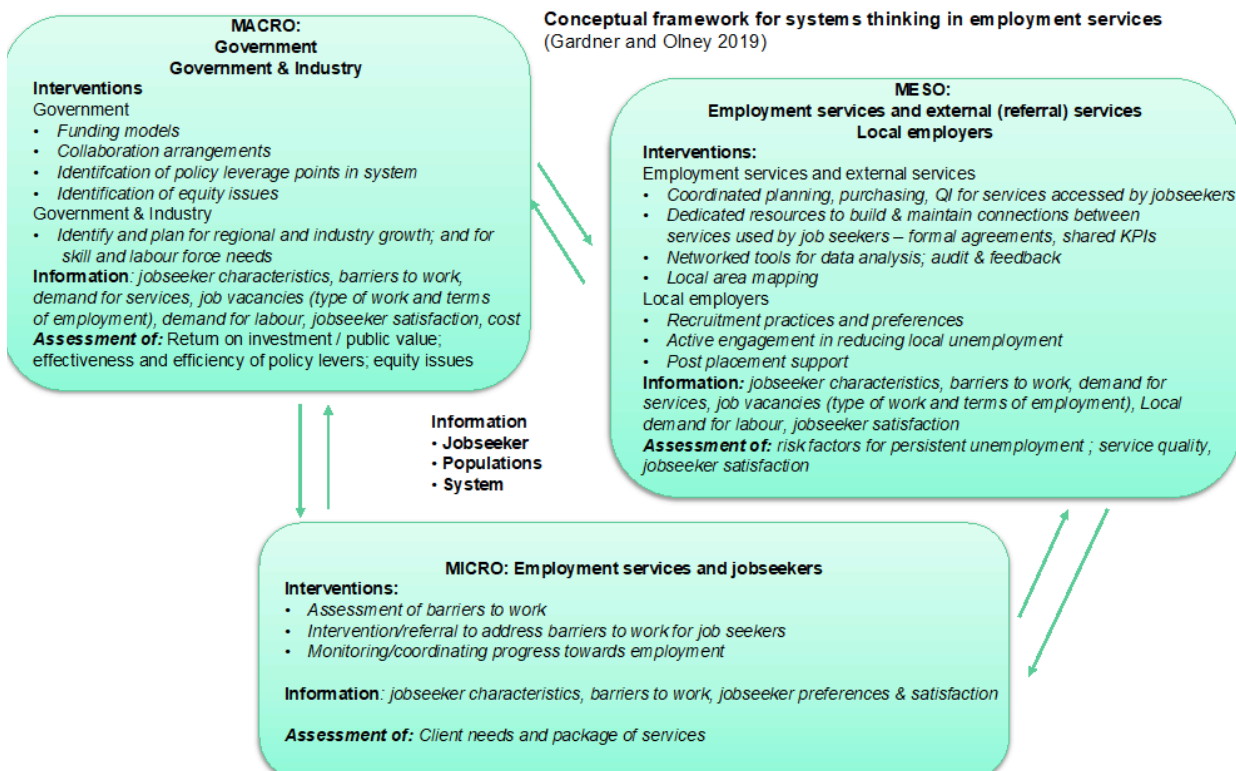
Type of complexity	Features	Example of potential action
Compositional complexity	Individual characteristics, geographic, familial, social, systemic, societal and economic factors can compound people’s marginalisation on multiple fronts	Person-centred design
Dynamic complexity	Systems are not fixed and stable, which can hamper cross-government and cross-sector collaboration and increase some people’s disadvantage over time	Monitor service gaps and overlap and identify shared areas for improvement.
Experiential complexity	People facing multiple and complex barriers to participating fully in society and the economy struggle to access public services built on underlying assumptions about their needs and circumstances.	Co design
Governance complexity	Various arms of government, their agents and organisations providing public services to common groups of citizens have competing or conflicting demands, aims or drivers.	Identify shared problems and common goals. Factor flow-on effects of policy reform into cost-benefit analysis. Use policy levers to change behaviour within the system.

3. Clarify policy goals at multiple levels and build in adaptive capacity for learning and improvement by supporting information flows and feedback loops that respond to complexity: an employment services example

A systems approach encourages a shift from the existing set of measurable outcomes and incentives for individuals and services providers to a system that supports the collection and use of data across multiple jurisdictions to improve service and to understand and monitor changes in market conditions, client outcomes, and public benefit. Figure 1 sets out the purpose for which data can be used at different levels of the employment services system and shows how de-identified data can be disaggregated and fed through the system from micro to macro levels to interrogate different policy questions. At the micro level data relate to assessing client need and the appropriate packages of care; at the meso level to risk factors for persistent unemployment among populations, service quality and client satisfaction; and at the macro level to questions of efficiency, effectiveness of policy levers, return on investment, public value and equity. Taking such an approach is not an easy task: it entails moving into the complex systems interventions advocated by Meadows (2009), thereby building system architecture and determining goals at different

levels of the system and agreeing collections of data with different stakeholders.

Figure 1: Conceptual framework for using data in the employment services systems

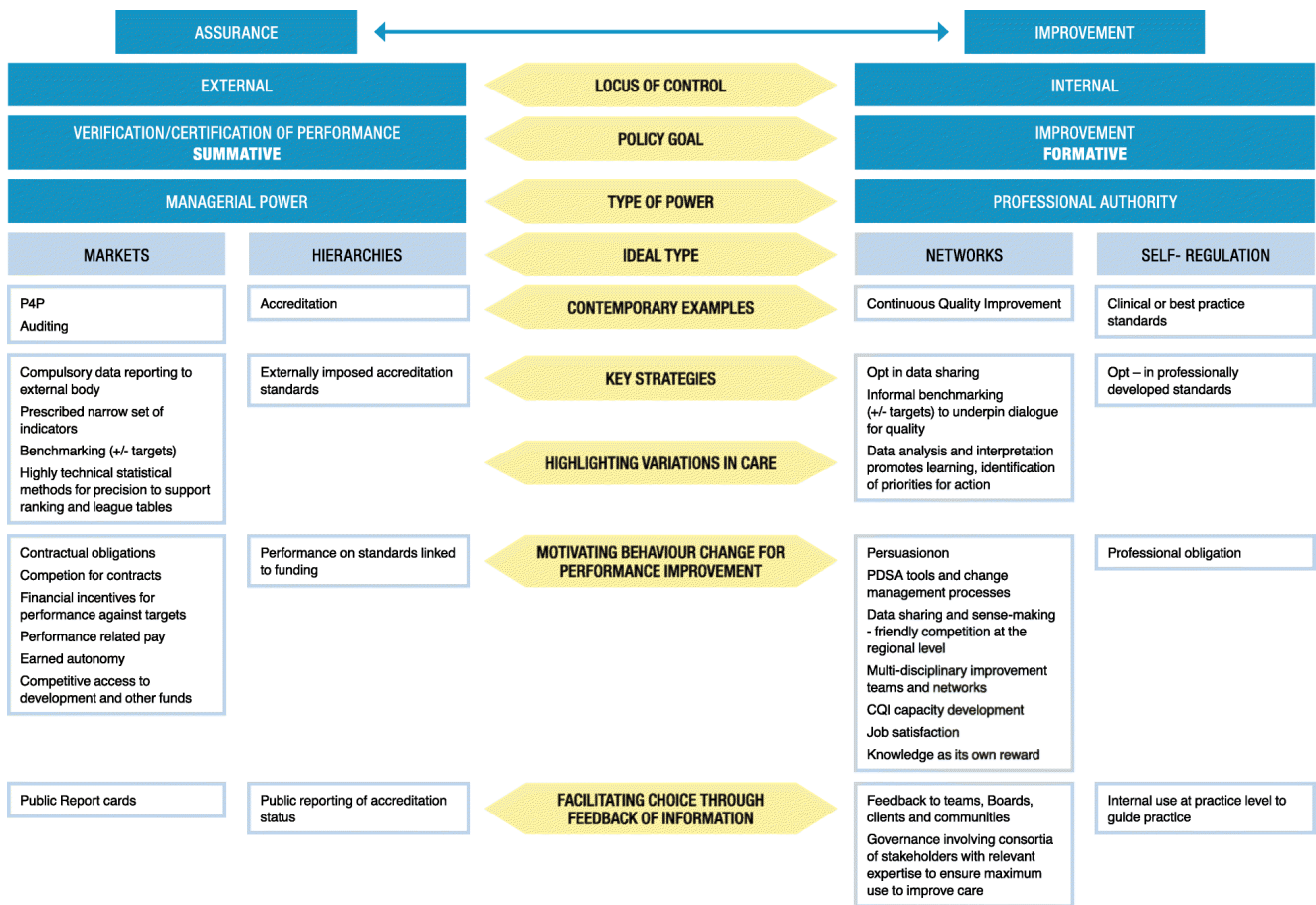


4. Reconsider incentives and extend performance management processes to support collective-action solutions and partnerships

There is usually no requirement or incentive for service providers within or outside government to consider the consequences of their interaction with people beyond their individual key performance indicators, and their efforts are not always mutually reinforcing. This is a key weakness in the institutional architecture of many systems engaged in delivering public services to common groups of citizens. Addressing policy issues like long-term unemployment, social and economic inclusion for people with disabilities, health or environmental issues, for example, calls for a coherent funding and performance measurement regime that rewards collective-action solutions and partnerships between services across jurisdictions to participate meaningfully in the community.

In theory, the market model of government services promises responsiveness, flexibility and accountability at a local level. In practice, the incentives and metrics for the multiple providers involved in delivering services to the same people are not mutually reinforcing. Figure 2 shows the continuum of current approaches to performance management, the policy goal and locus of control of each of these alternatives as well as the key strategies used to underpin their implementation. Externally driven performance management systems exercise managerial power to verify levels of performance for accountability to governments and funders (often as part of contractual funding arrangements) and more internally controlled systems based on professional authority seek to promote quality improvement by leveraging actors' legitimacy and authority to build relationships across boundaries to improve and/or redefine desired outcomes such as through structured improvement programmes. Extending performance management systems to include improvement systems that engage providers in developing collective action solutions is consistent with a systems approach.

Figure 2: Performance management approaches and their component parts



From: Gardner, Olney, Dickinson 2018, <https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-018-0401-2>

This review has highlighted areas in which systems thinking can be applied to future research and practice. It is hoped that applying lessons from the literature and taking action across any or all of the four areas of stewardship discussed above will assist policy makers and other stakeholders in government and the services sector to improve the design, delivery and evaluation of effective policy and to manage risk in complex and dynamic environments. For the Public Service Research Group, systems thinking and stewardship will continue as major areas of research activity in an effort to further develop the evidence base.

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APPENDIX I METHODS

This review drew on data from a systematic scoping review of the Public management and systems science literature to explore the question: How are systems thinking and complexity theory used in public management and administration research?

Article searches were conducted on 30-Aug-2018 in the UniMelb Discovery database, using the following search terms.

Search terms	Filtered: date; English language; peer review; exact terms	UniMelb duplicates removed
"public management" AND ("systems thinking" OR "systems science" OR "complexity theory" OR "complexity science" OR "agent based modelling" OR "network analysis" OR "soft systems methodology" OR "system* dynamics" OR "system* modelling" OR "causal loop" OR "system* map*" OR "complex adaptive system*" OR "group model building")	257	196
"public administration" AND ("systems thinking" OR "systems science" OR "complexity theory" OR "complexity science" OR "agent based modelling" OR "network analysis" OR "soft systems methodology" OR "system* dynamics" OR "system* modelling" OR "causal loop" OR "system* map*" OR "complex adaptive system*" OR "group model building")	1254	1055
"public policy" AND ("systems thinking" OR "systems science" OR "complexity theory" OR "complexity science" OR "agent based modelling" OR "network analysis" OR "soft systems methodology" OR "system* dynamics" OR "system* modelling" OR "causal loop" OR "system* map*" OR "complex adaptive system*" OR "group model building")	1248	1011
total (duplicates removed Uni Melb)		2262
total (duplicates removed in Endnote)		1751

SCOPING

Following removal of duplicates and articles that were not relevant to the review due to content or type of article (eg book preview, conference notes) (n= 985) a total of 766 articles remained.

The team then categorised according to:

Category	No. of articles
A. Empirical study of a policy issue using systems science (SS) tools	368
B. Empirical studies that evaluate the use of systems science/methodologies in policy settings.	90
C. Theoretical approaches to public administration and public management	73
D Those that use particular models (e.g. Social Network Analysis) but do not offer policy context/implications	130
Not relevant/exclude	104
Empirical (A and B)	458


Articles from Category A and B informed this issues paper.

APPENDIX 2 EXAMPLE PAPERS

Category	Papers
<p>Reconceptualising policy and systems issues using systems theory and methods</p>	<p>Tenbenschel T. (2018) Bridging complexity theory and hierarchies, markets, networks, communities: a 'population genetics' framework for understanding institutional change from within. <i>Public Management Review</i> 20:7, 1032-1051</p> <p>Sinclair S. (2011) Partnership or Presence? Exploring the Complexity of Community Planning. <i>Local Government Studies</i>, 37 (1), 77-92.</p> <p>Meek K, Marshall KS. (2017) Cultivating resiliency through system shock: the Southern California metropolitan water management system as a complex adaptive system. <i>Public Management Review</i> 20:7, 1088-1104, DOI: 10.1080/14719037.2017.1364408</p> <p>W. Kambidima (2017) Using systems thinking to conceptually link the monitoring and evaluation function within development interventions and public policy. <i>The Journal for Transdisciplinary Research in Southern Africa</i>, 13:1, e1-e13</p> <p>Gear CE, Koziol-McLain J. (2018) Utilizing complexity theory to explore sustainable responses to intimate partner violence in health care. <i>Public Management Review</i> 20:7, 1052-1067, DOI: 10.1080/14719037.2017.1364407</p> <p>Boland A. (2000) A systems perspective of performance management in public sector organisations. <i>International Journal of Public Sector Management</i> 13:5, 417-446.</p> <p>DOI:10.1108/09513550010350832</p>
<p>Modelling aspects of systems such as interrelationships, self-organisation, or resilience</p>	<p>van den Belt MK, Krueger JR, Maynard E, Roy A, Galen M; Ian R. (2010) Public sector administration of ecological economics systems using mediated modelling. <i>Annals of the New York Academy of Sciences</i> 11851:1,196-210</p> <p>Rhodes, MLD, Conor. (2018) What insights do fitness landscape models provide for theory and practice in public administration? <i>Public Management Review</i> 20(7), pp.997-1012</p> <p>Linkov DA, Bates ME, Chang D, Convertino M, Allen JH, Flynn SE, Seager TP. (2013) Measurable Resilience for Actionable Policy. <i>Environmental Science and Technology</i> 47:18, 10108-10</p> <p>Kim YJ, Erik W, Kang HS. (2013) A Computational Approach to Managing Performance Dynamics in Networked Governance Systems. <i>Public Performance and Management Review</i> 34:4,580-597</p> <p>Herrera H. (2017) From Metaphor to Practice: Operationalizing the Analysis of Resilience Using System Dynamics Modelling. <i>Systems Research & Behavioral Science</i> 34:4, 444-462</p>
<p>Consideration of new ways to govern and evaluate public services</p>	<p>Ofek Y. (2015) The Missing Linkage In Evaluating Networks: A Model for Matching Evaluation Approaches to System Dynamics and Complexity. <i>Public Performance and Management Review</i> 38:4, 607-631</p> <p>Murninghan M. (2011) Improving Impact: Collaborative Multi-Party, Multi-Sector Engagement. <i>New England Journal of Public Policy</i> 30:1, 1</p> <p>Eppel E. (2016) Towards better understanding the mechanisms which create sustainable public services organizations and systems. <i>Emergence: Complexity & Organization</i> 8:11, 526</p> <p>Cosnez F. A (2014) Dynamic Viewpoint to Design Performance Management Systems in Academic Institutions: Theory and Practice. <i>International Journal of Public Administration</i> 37:13,955-969</p> <p>Cockerill L, Malczynski L; Tidwell V. (2009) A fresh look at a policy sciences methodology: collaborative modeling for more effective policy. <i>Policy Sciences</i> 42:3, 211-225</p>

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