#### UNCITRAL Colloquium on PPP

#### Vienna 2 & 3 May 2013

Speaking points – Dr David Dombkins

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- 1. PPP Laws are Complex Policy
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Attachment: Realizing Complex Policy: Using Systems-of-Systems

#### 1. PPP laws are complex policy

The attached paper on *Realizing Complex Policy* provides a systems-of-systems<sup>1</sup> based methodology for countries to fast track their development of PPP readiness.

Although the effectiveness of PPP laws is dependent upon the strength of various enabling capabilities and policies within a country, it can be impracticable to develop a single comprehensive law that integrates all these enabling policies and systems. Rather, countries can more effectively develop their PPP capabilities by leveraging-off their existing policies and systems, using a Staged Evolutionary Strategy operating as a systems-of-systems.



Figure No.1 – Using a Staged Evolutionary Strategy to establish a PPP Capability in a developing country

Figure No.1 depicts a Staged Evolutionary Strategy for developing a PPP policy using pilot projects. The policy development and implementation risks are greatly reduced by using a staged evolutionary strategy to merge and integrate the multiple component policies.

A systems-of-systems based staged evolutionary strategy to develop a country's PPP capability will initially identify the component policies and systems that enable effective PPPs, and then develop an evolutionary strategy to progressively build the country's PPP capability. The initial iteration will establish a PPP Unit within a suitable Central Government Department, draft PPP laws and regulations, and bring together a limited number of component polices (Finance Policy, Procurement Policy and Public Governance) to establish a PPP Policy Systems-of-Systems.

Supported by the initial PPP Policy Systems-of-Systems, pilot PPP projects will be identified and initiated. Concurrently with these pilot PPP projects, planning will be undertaken to introduce more component policies (Education, Superannuation, Sustainability, etc.) into the PPP policy systems-of-systems. As the PPP policy systems-of-systems is progressively developed, the number of PPP projects increases. This cyclic development process for the PPP policy systems-of-systems is indefinite.

<sup>&</sup>lt;sup>1</sup> A systems-of-systems is defined as a set or arrangement of component systems that results when independent and useful component systems are integrated into a larger system that delivers unique capabilities.

#### SUMMARY: NATIONAL PPP READINESS SELF-ASSESSMENT

Developing Country	2-Dec-2012
Assessor	
Name: Dr David Dombkins	
Position: insert here	
Assessment	-
1.105 Fair	© UNECE 2010
	Version 1.0

Area of Na	tional PPP Readiness	Score	Remarks
Area #1	PUBLIC GOVERNANCE	2.209821429	Moderate
Area #2	POLICY	1.132222222	Fair
Area #3	CAPACITY-BUILDING	0.539835165	Poor
Area #4	LEGAL FRAMEWORK	1.114583333	Fair
Area #5	WHOLE-OF-LIFE PROJECT DELIVERY	0.830856643	Poor
Area #6	SUSTAINABLE DEVELOPMENT	0.952380952	Poor
Area #7	PROJECT MANAGEMENT	0.454545455	Poor
Area #8	FINANCE	1.603174603	Fair

National PPP Readiness Self-Assessment



Figure No.2 – PPP Readiness assessment for a developing country

The UNECE PPP Readiness Assessment Tool <sup>2</sup> provides a useful framework to understand the complexity of PPP Policy. The Readiness Assessment Tool assesses a country's readiness for PPP across eight separate areas, each representing a different enabling capability to support successful PPP delivery. As depicted, the legal framework is only one aspect of this PPP Readiness. Whilst more developed countries may already possess these enabling capabilities to varying degrees, many developing countries do not.

The sample UNECE PPP Readiness Assessment shown in Figure No.2 is for a developing economy – it highlights the scope of capability development required to effectively support PPP. Due to the wide scope of necessary enabling capabilities, it is impractical for a government to attempt to develop its PPP readiness across all capabilities simultaneously. The Staged Evolutionary Strategy using a systems-of-systems approach provides a lower risk strategy for developing countries to establish their PPP capability. PPP law needs to be structured appropriately to support this progressive development of the country's PPP capability.

<sup>&</sup>lt;sup>2</sup> <u>http://www.unece.org/fileadmin/DAM/ceci/documents/2011/ppp/eArticles4/20.2\_UNECE\_National\_PPP\_readiness\_self-assessment\_english.pdf</u>

#### 2. Procurement

In drafting PPP laws, consideration should to be given to the impact of existing procurement policies and regulations, and the specific procurement requirements for PPP projects:

- PPP Laws need to support the full range of PPP strategies.
- The Rules of Tender need to be designed so that the Expression of Interest and Request for Submission are not categorised as forming part of the formal tender process. This allows the freedom to use processes such as Competitive Dialogue (an interactive tender process<sup>3</sup>) to drive scope clarification in tender submissions, and thereby reduce both risk and cost. The formal tender is only instigated at the Best and Final Offer stage.
- Unless there are exceptional circumstances, PPP projects should be competitively tendered. Where an unsolicited offer is made, a Swiss Challenge<sup>4</sup> can provide governance and maintain the benefits of competition.
- Tender costs can be reduced by using an Expression of Interest to shortlist a small number of suitably competent tenderers.
- PPP Laws need to include provision for contract management.
- Due to the generally long-term nature of PPP projects (ten to twenty years), it is appropriate for the procurement process to validate the business need, value for money, risks, and whole-of-life outcomes of the project. The two stages of the Value-at-Entry<sup>5</sup> process provide a reliable methodology to assess and validate the benefits of PPP projects.

<sup>&</sup>lt;sup>3</sup> An interactive tender process involves holding a series of individual interactive workshops with shortlisted bidders during the RFP bid phase. An interactive tender process provides shortlisted bidders with an opportunity to discuss the development of their concepts and designs and to seek clarification and feedback in the context of the government's output requirements, before lodging proposals. The workshops also minimize the risk of any misunderstanding of the government's requirements.

<sup>&</sup>lt;sup>4</sup> A Swiss Challenge is a form of public procurement used in some jurisdictions, which requires a public authority (usually a government agency) that has received an unsolicited bid for a public project (such as a port, road or railway) or services, to publish the bid and invite third parties to match or exceed it.

<sup>&</sup>lt;sup>5</sup> Under the Norwegian Quality-at-entry regime, pre-qualified external consultants are assigned to perform quality assurance of the decision basis in all public investment projects. The process includes two separate quality assurance exercises in sequence.

#### 3. Sources of PPP Funding

This paper proposes that for a specific class of Nation Building projects, a new class of PPP projects should be established, where these PPP projects will be owned freehold by superannuation funds and asset managers. The superannuation funds and asset managers can then take advantage of both income and capital growth.

Superannuation and asset managers can provide a significant and low-cost source of finance for PPP. PPP and finance laws should be designed to promote the use of superannuation and funds as a key source of financing for PPP projects that deliver civil and social infrastructure. There is a need for strategies promoting superannuation and asset manager investment in PPP projects.

The traditional PFI model as developed in the late 1980's, was premised upon projects being returned to public ownership at the end of their term, and at which point the concession agreement would be terminated. However, in practice this rarely occurs, with governments generally continuing to apply access/use fees after the PFI project has been returned to government ownership.

This approach will significantly assist those governments that need to deliver civil and social infrastructure that cannot be funded through taxation. An appropriate selection criteria and prioritisation process can be used to define the set of Nation Building PPP projects. Nation Building projects can then be developed using the following process:

- The policy and laws governing superannuation and asset manager investment should specifically allow investment in the ownership of Nation Building PPP projects. Nation Building Projects ownership has special conditions to ensure that these projects continue to add value to the community:
  - Can only be owned by superannuation funds or approved asset managers.
  - There must be continuity of services delivery (operation of roads, rail, etc)
  - There is no tax or GST on the project (Governments are not losing taxation as without funding from superannuation / asset managers there would be no projects)
  - Governments guarantee a minimum income stream.
- A viable market of superannuation funds and asset managers is established.
- Governments will benefit from not having to directly fund infrastructure projects, and the economy benefits through both the construction of infrastructure, and the improved economic performance this infrastructure enables.
- Governments should initiate and take responsibility for Nation Building PPP project development, and competitively tender each project's design, implementation and initial operation (to the point where operational income has stabilised).
- Governments and/or development banks should establish an interest-free dedicated fund to provide seed finance for Nation Building PPP project development. Once a Nation Building PPP project is sold to a superannuation fund or asset manager, these funds should be returned to the fund, and reused to support the development of further Nation Building PPP projects.
- Once a Nation Building PPP project is completed and its income stream stabilised, superannuation funds should competitively bid to take freehold ownership of the project.

- The ongoing operation, maintenance and asset management of Nation Building PPP projects should be outsourced by the superannuation fund to the private sector, using alliancing or governance contracting strategies.
- Usage/concession fees should be set to: cover maintenance and operational cost; provide a sinking fund for asset management; and to provide the superannuation funds / asset managers with an acceptable return on initial investment. With inflation, the impact of the usage fees on the community will be reduced.
- Ongoing ownership of the Nation Building projects allows superannuation funds / asset managers to:
  - Include capex gains in calculating returns
  - Sell projects to other superannuation funds / asset managers to realise capex gains
- Governments can sell existing infrastructure assets to superannuation funds / asset managers.

## REALIZING COMPLEX POLICY

Using Systems-of-Systems

April 2013 Version 1.5



#### About the Author

**Dr David H Dombkins** is Australia's first Doctor of Technology (project management of complexity). Dr Dombkins:

- authored the International Competency Standard for Complex Project Management for the Australian Government.
- developed the WAVE Planning methodology for the planning and emergent management of complex strategies and programs.
- worked with the United Nations in developing capability building methodologies and best practice guides for countries.

#### Acknowledgements

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The paper integrates and contextualizes: Dr Dombkins 1996 WAVE Planning Model; The Australian Government's 2006 Complex Project Management Competency Standard; Jake Chapman's 2002 book on Systems Failure; David Alert and Richard Hayes 2007 book on Planning Complex Endeavors; The International Institute for Sustainable Development 2009 book on Creating Adaptive Policies; the Institute of Government 2011 publication on Systems Stewardship; the Institute for Public Policy Research 2012 publication on a Complex New World; and the US Office of the Secretary of Defense work in systems-of-systems.

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### 1. Executive Summary

### Rather than focusing on policy content, this paper provides a robust methodology for governments to design, implement, deliver, and manage emergent complex policies.

There is a broad acceptance that the existing policy making methodology and its theoretical foundations are not effective in today's complex world.

In response to these policy failures there is a growing number of new ideas for policies in economics, education, sustainability, energy, health, etc. being developed that are based on complexity, emergence, and adaptive systems.

While there is considerable merit in these new policy ideas, they lack detail in HOW they can be effectively designed and realized.



The paper defines three distinct policy strategies: Bespoke, Evolutionary, and Emergent and provides a tool for categorization of policies. Each policy strategy has a range of applications dependent upon its complexity and uncertainty.

This paper's focus is on providing governments with reliable strategies and methodologies to design and realize complex policies.

The paper brings together policy, complexity, and the innovative work from defense. Many of the terms and language used in the paper draw from complexity and the work undertaken in defense.

Whilst some of the ideas presented may not be easily understood, the paper provides a valuable foundation for governments and researchers to develop strategies, methodologies, and capabilities to deal with the world's most pressing complex issues.



### **2. Introduction**

The future of our 'quality-of-life' and 'sustainability' are dependent upon today's policies for complex real world issues in sustainability, health, economic development, defense, infrastructure, energy, education, etc. These complex world policy issues cannot be resolved by using the traditional strategy for policy design and implementation. Neither can they be resolved through attempting to establish meta policies that integrate multiple component policies.

Real world complex policies are very difficult to design and plan, as they are complex adaptive systems that are affected by: ongoing social, political, financial, technical, change; and emergence. Adding to the complexity is the delivery of complex policies through multiple agents where the policy owner often does not have directive control over the agents. Traditional methodologies, where planning is completed by experts and then sequentially implemented and delivered, are inappropriate for complex policies.

This paper presents strategies and methodologies for the design, implementation, delivery and emergent management of complex policies. The development of strategies and methodologies for the management of complexity has been a pivotal issue in defense, where asymmetric warfare and network-centric warfare are complex endeavors that cannot be designed, planned, implemented, and operated using traditional strategies and methodologies.



WAVE Planning is easily understood, and facilitates planning.

This paper integrates WAVE Planning, with systems thinking, systems-ofsystems, stewardship, process governance, partnering, and integrated policy teams to develop robust strategies and methodologies for the realization of complex policies.

Complex policy is non-linear and recursive, and does not reflect the sequential planning of the traditional approach.

WAVE Planning is used to convert this difficult to understand model into a pattern that appears linear, as shown below.



WAVE Mode: developed by Dr David Dombkins

### 3. Policy for a complex world

The great achievements in science and engineering have created high expectations in the broader community. While the scientific method is very effective in many areas, its reductionist and deductive based approaches are notably unsuccessful in complex policies. Research into complex policies has found:

- Complex policies operate as networks, are not able to be decomposed into basis elements, are not able to be predicted, and are emergent.
- Policy formulation and implementation are not separate, but intrinsically linked.
- The potential outcomes of the policy itself may change significantly during implementation.
- Complex policies involve multiple stakeholders and agents that the policy owner cannot directly control.
- The outcomes of complex policies are often adapted as they are realized in practice. Complex policies are not just made and then executed; they are made and constantly re-made by the multiple players interacting in a system.

Policies vary in the level of predictability. Therefore, different strategies and methodologies are required for different types of policies.

This paper provides three different strategies with (Bespoke, Evolutionary, Emergent) to consider in policy design, implementation and delivery.



**Policy Uncertainty** 

#### Bespoke

The Bespoke strategy is suited to policy areas where the policy can be fully designed and planned in advance and when a centralized and directive control system can effectively supervise the policy's implementation and delivery. The bespoke strategy uses evidence based deductive approach in policy design, and a linear, centralized, and a directive approach in planning for implementation and delivery of policies.



Linear Planning process for Bespoke Strategy

The bespoke strategy defines specific goals and develops detailed implementation plans, in a way similar to the engineering design process used for bridge construction. In the same way that engineers use levers to drive machines, governments have used bespoke strategies as levers to drive change in society.

Key to the Bespoke strategy is the capability of the design process to turn the government brief into very detailed and integrated plans and specifications. The bespoke strategy is dependent upon the accuracy of the design and the implementation and delivery strategy to deliver a fully operational service on day one. Traditional project management and systems engineering provide reliable tools and processes for the implementation and delivery of the detailed bespoke policies.

Policies can fail when the wrong strategy is selected. For example, policies that have a high reliance on technology or applications are suited to emergent policy strategies that enable technical risks and service delivery models to be resolved before a broad rollout of the policy.

#### Evolutionary

An Evolutionary strategy is based on using the same processes that are used for the bespoke strategy sequentially to progressively refine and build the capability of the policy. The evolutionary strategy is suited to complicated policies that require the integration of multiple bespoke policies.

There are two types of Evolutionary Strategy:

<u>Staged Evolutionary Strategy</u> - As shown, the Staged Evolutionary strategy allows for an initial version of the policy to be released (providing a limited policy scope), with subsequent iteration of the policy delivering greater policy scope.



The Staged Evolutionary strategy uses pilot projects and a staged rollout of the policy. For example, the establishment of a central agency for social services that brings together multiple component policy areas (unemployment, family, childcare, etc.) into a one-stop shop. The risks are greatly reduced through using a staged evolutionary strategy to merge and integrate the multiple services.

<u>Refinement Evolutionary Strategy</u> – In the Refinement strategy, an initial policy design and realization plan are completed. The policy design and realization plan are then progressively refined through putting them through a series of reviews and development cycles. This strategy is focused on decreasing uncertainty and increasing integration prior to the policy's implementation and delivery. Uncertainty decreases as the project moves toward completion



A Refinement Evolutionary strategy is very effective in progressively bringing in more levels of detail and issues into a policy. However, the effectiveness of this strategy is dependent upon the rigor of the design management process.

As shown, the design process goes vertically from concept to detail, that is, from very broad issues such as design philosophy in the concept phase, down to fine definition of details. In moving from concept to detailed design, the design process follows a cyclic process, cycling between divergent abstract ideas, then through convergent concrete realization, back through abstract ideas, and so on.





Milestone review points facilitate this divergent and convergent thinking process — divergent thinking focus allows for innovation and creativity and convergent thinking allows the mind to make as many connections as it can and to integrate.

Milestone review points are crucial in managing the design process when there are multiple parties involved in the design process. The individual designers are re-benchmarked at each milestone review point, so that all the designers then proceed to the next part of the design from the same position. After the milestone point, the individual designers will again diverge, but will be re-benchmarked again at the next milestone point.

#### Emergent

Policies that need to bring multiple systems together to deliver a higher order outcome or that are subject to ongoing frame-breaking change in underpinning aspects, are subject to emergent behavior. Emergent behaviors appear when the components of the policy interact to deliver unpredictable outcomes. These unpredictable outcomes can be both beneficial and detrimental to the policy.

Some complex policies operate as complex adaptive systems that can be pushed out of balance even to the point of collapse through negatively reinforcing emergence. In fact, when an effort is made to influence a complex adaptive system, those seeking to influence become part of the complex adaptive system.

The Emergent Strategy enables policies to have a broader impact, but, because of their unpredictability, restrict the policy owner to establishing high-level outcomes, and an ongoing re-designing process to deal with emergence.

Emergent strategies have to be able to:

- Bring together multiple other component polices and systems (that may not be under the direct control of the policy owner) to deliver a higher order policy outcome using a systems-of-systems.
- Accommodate change in the component policies and systems Policies that

display emergent characteristics need shell designs that can accommodate a plug and play approach with component policies being replaced and new policies being added.

- Use stewardship, as opposed to direct control.
- Be planned using WAVE Planning, in lieu of traditional project management.

The Emergent Strategy is suited to complex policies.

The following table shows key characteristics of the three strategies:

	Bespoke	Evolutionary	Emergent
Suited to:	Policies with clear scope and that are reliably predictable	Policies that integrate multiple bespoke policies	Complex policies
Brief	Specific changes	Specific changes	High level goals
Design	Policy design and strategy fully detailed prior to implementation	Multiple cyclic design iterations used to fully integrate all component policies prior to implementation	Not able to develop a detailed design before implementation, Ongoing cyclic process between design and delivery
Implementation	Sequentially follows design Implementation fully planned in advance Centrally controlled	Sequentially follows design Pilot project may be used Implementation fully planned in advance Centrally controlled	Ongoing cyclic process between design and implementation Multiple component policy owners and agents implement policy Policy owner often does not have direct control
Delivery	Through directly controlled central government departments and agents		Through multiple component policy owners and agents not controlled by the policy owner
Ongoing management	Incremental change to tight rules	Ongoing emergence Policy redesigned repeatedly	
Methodology	Traditional policy desig delivery methodologies	WAVE Planning, systems-of-systems, stewardship, process governance, integrated policy teams, and Partnering.	

### 4. Sensemaking and Foresight

Policies are driven by philosophy, visions, or a desire for change. Thus, policies have an intent, one that is shared to different degrees by those participating. This is particularly important in complex policies where agents play a key role in the implementation, delivery, and emergent development of the high-level policy goals. Therefore, a successful complex policy requires that the agents are able to make sense of the policy individually, in the context of their respective roles, as well as collectively.

Making sense of the situation, *sensemaking*, begins with putting available information into context and identifying the relevant patterns that exist. Therefore, sensemaking begins with the development of situation awareness.

Situation awareness includes awareness of the policy high-level strategic goals. In the process of developing situation awareness, the policy owner and agents may determined that more information is needed before policy design or policy redesign.

Sensemaking involves more than developing situation awareness - it goes beyond what is happening to include what may happen and what can be done about it.

As shown, sensemaking involves ongoing analysis, modeling, and prediction, across multiple domains (social, information, physical, cognitive, and political).

The need to consider a wide range of effects and the cascades of effects that take place in the multiple domains requires more knowledge, experience, and expertise than when only the policy specific effects are considered.



This is one of the major reasons why effects based approaches such as social, economic, political, etc., to planning, benefit from a complex approach to policy.

#### Foresight

While evidential support is important in policy development, there is a growing awareness that much of the evidential support for traditional strategies and tactics is neither valid nor reliable - this lack of reliable evidential support makes prediction worthless. This inherent problem with evidentiary support is compounded by the emergent nature of complex policies that are affected by ongoing emergence.

Emergence is in turn complicated by the growing incidence of asymmetric strategies and tactics with corporations and governments seeking to gain strategic advantage through getting around, and/or, taking advantage of government and international policies.

To succeed in this complex world, governments need a new way of thinking that is in tune with our complex world and where *'uncertainty is the only certainty'*.

No one can predict the future and herein lies the fundamental weakness in policy making - in our complex world it is extremely difficult to model real world political, financial, social, economic, technical, and environmental systems. This complexity is made substantially more difficult with the past providing little guidance for predicting the future, asymmetric behavior becoming the norm, and frame-breaking changes occurring regularly.

The best we can do is to understand that the real world is a complex system, and use this understanding to develop policy making strategies and methodologies that allow us to develop policies and implementation frameworks that can deliver tangible outcomes today, while having the capability to introduce changes without significant rework or interruption to continuity.

Not all policies are complex. Therefore, policy makers will be more effective if they purposefully view different types of policies through different lenses.

Different Lenses for Policy Makers					
Bespoke and Evolutionary Strategies	Emergent Strategies				
hindsight	foresight				
deductive reasoning	inductive reasoning				
close system	open system				
close coupled	loose coupled				
predictive	asymmetric				
linear	recursive and non-linear				
certainty	uncertainty				
stable	emergence				
silos	systems-of-systems				

Foresight for the complex policies can be developed through modeling combined with WAVE Planning, connective planning, systems thinking, and agent based modeling. Combined, these methodologies and tools provide an understanding of our complex world, and foresight into complex policy design, implementation, delivery, and emergence.

Three toolsets support policy owners in developing foresight: Systems Thinking; Multiple Views; and Technical and Enterprise Readiness Index.

#### Systems Thinking

Systems thinking provides policy makers with a range of tools to support design and sensemaking. The following table allocates appropriate systems thinking tools to each of the policy strategies and takes into consideration the nature of the policy environment.

Policy	Policy Environment						
Strategy	Cooperative Pluralistic Coercive						
Bespoke	SD	SAST, MV	CSH, MV				
Evolutionary	VSD, CP, P, RP, LM	SAST, CP, RP, MV, LM	CP, RP, MV, LM				
Emergent	SSM, CP, P, RP, ABM, MV, LM	IP, SSM, CP, RP, ABM, MV, LM	CP, RP, ABM, MV, LM				

SD – System Dynamics; VSD – Variable Systems Dynamics; SAST – Strategic Assumption Surfacing and Testing, IP – Interactive Planning; SSM – Soft System Methodology; CSH – Critical System Heuristics, CP – Connective Planning, P – Partnering, RP – Rich Pictures, ABM – Agent Based Modelling, LM – Logic Maps, and MV – Multiple views

#### Multiple Views

Bounded rationality is one the greatest risks in policy design. A structured process that looks at the policy through multiple views provides the policy owner with a holistic understanding. These multiple views can be developed and integrated using a range of systems thinking tools.



#### Technical and Enterprise Readiness Index

Tools such as Technology Readiness Level (TRL), Integration Readiness Level (IRL), Systems Readiness Level (SML), and Enterprise Readiness Level (ERL) provide key inputs into policy development and implementation planning.



With Foresight governments:

- Have voluntarism and are not so easily swept along by events outside their control;
- Have the ability to steer emergence;
- Can proactively feed forward to influence the future;
- Can leverage legacy systems, while providing a framework that can readily take up new technologies;
- Can proactively invest in and take advantage of future technologies; and
- Can proactively intervene to more effectively use legacy and future technologies.

# 5. Evidentiary support for Policy Design

Because of the varying levels of certainty and risk, different approaches to evidence to support decision-making are appropriate for the three Policy strategies (Bespoke, Evolutionary, and Emergent).

In an idealized world, decision makers would set clear goals, gather all necessary relevant information related to the problem and desired solutions, and then devise alternatives to meet goals. Alternatives would then be prioritized and choices would be made based on agreed upon criteria. This process would be supported by accurate information, which would reduce the uncertainties and risks in policy making along with general theories, and would guide the comparison of alternative solutions.

The intent is to improve policy making through establishing validity between the policy strategy, the level of supporting evidence, and the focus of the policy (high level or detailed). However, this ideal approach is seldom realized in government.

Policy makers have two distinctly different scientific research methodologies (Empirical and Grounded) available to them:

- Empirical research is based on theory, predictions (formulas), and experimentation. Theories and experimentation simplify problems through using deductive thinking to focus on a limited number of variables and ignoring the noise from a complex world. Empirical research provides very detailed causal relationships between a small number of variables that can be used to develop very detailed policies (Bespoke and Evolutionary Policy strategies).
- Grounded research focuses on the real 0 world using inductive thinking to develop a holistic system understanding. Complex policies usually have a variety of interacting variables. multiple interdependent processes operating simultaneously, and exhibit behavioral patterns that are non-linear, recursive, and grounded emergent. The research approach is suited to provide evidence to develop high-level goals and guidance for Emergent Policy strategies. The WAVE Planning methodology and recent advances in agent-based modeling provide effective testing and evaluation processes of complex policies.



Evidentiary support for complex policy owners is provided by both the Grounded and Empirical methodologies of scientific research with each of the two scientific methodologies providing different computational and modeling processes. The following table summarizes the differences between Bespoke, Evolutionary, and Emergent strategies.

	Bespoke	Evolutionary	Emergent
Decision making	Deductive	Deductive	Both inductive and deductive
Philosophy			
Design	Full detail design	Full detailed design	High level vision
		using multiple cycles	
Level of certainty	High	High	Low
Level of change	Low	Low	High
Integration	Full integration	Full integration	Umbrella systems
			integration systems with
			loose component integration
Governance	Direct supervision	Direct supervision	Stewardship
Implemented	Through the formal	Through the formal	Through multiple agents the
	bureaucratic	bureaucratic	policy owner has limited, if
	structure	structure	any, direct control over
Empowerment	Centralized control	Centralized control	Empowered agents
Delivery	Through the formal	Through the formal	Through multiple agents the
	bureaucratic	bureaucratic	policy owner has limited, if
	structure	structure	any, direct control
Innovation in delivery	First time right	Options: first time	Ongoing innovation by
	Incremental	right, or staged	agents
	improvement	delivery with	
	-	incremental	
		improvements	
Outcomes	Standardized	Standardized	Can vary across agents

Policies designs are driven by philosophy, vision, and/or problems. Regardless of the policy driver, policy owners are faced with the issue of policy design. However, depending upon the type of policy, (bespoke, evolutionary, or emergent) different approaches to policy design are required.

The heuristics for policy design are:

- Don't do the detail beyond the certainty horizon;
- o Bounded rationality will drive policy design;
- Understand the policy holistically before commencing design; and
- Understand the policy design cost model: designing the policy to a cost; or costing the policy design.

### 6. Policy Categorization Tool

There are three different strategies for policy design, implementation, and delivery: Bespoke; Evolutionary; and Emergent.

The Policy Categorization Tool (PCAT) provides a tool for Governments to categorize policies and to select: an appropriate strategy for the design, implementation, and delivery of policies; select appropriately competent policy leaders and teams; and select appropriate governance, rules, feedback, and response for each policy category.

#### POLICY CATEGORIZATION TOOL

PCAT Category	Policy Strategy
1 - Highly Complex 2 - Complex	Emergent
3 - Complicated	Evolutionary
4 - Traditional 5 – Simple	Bespoke

The PCAT Tool categorizes policies into one of five categories:

#### **Complex Policies**

Increasingly, governments are faced with policies that are not merely complicated, but truly complex. Complex policies involve changes and behaviors that cannot be predicted in detail, although those behaviors and changes can be expected to form recognizable patterns. Complex policies are also characterized by circumstances in which relatively small differences in initial conditions or relatively small perturbations (seemingly tactical actions) are associated with very large changes in the resulting patterns of behavior and/or strategic outcomes.

**PCAT1** are policies that are driven by a vision and have the following characteristics:

- $\circ$  high levels of emergence
- high internal system complexity
- high external system complexity
- politically critical

PCAT 2 are policies that are driven by a vision and have the following characteristics:

- $\circ$  high levels of emergence
- high internal system complexity
- high external system complexity
- o politically important

#### **Complicated Policies**

Complicated policies are characterized by having many parts or actors and are highly dynamic, that is, the elements of these policies constantly interact with and impact upon one another. However, the cause and effect relationships within a complicated policy are generally well understood, which allows planners to predict the consequences of specific actions with some confidence.

**PCAT 3** are policies that are driven by defined outcomes/outputs and have the following characteristics:

- o low to medium levels of emergence
- o moderate internal system complexity
- o moderate external system complexity
- moderate political importance

#### **Traditional Policies**

Traditional policies are readily decomposed in definable elements and have cause and effect relationships that are generally well understood, which allows planners to predict the consequences of specific policies with confidence.

**PCAT 4** policies have the following characteristics:

- $\circ$  low levels of emergence
- low internal system complexity
- low to moderate external system complexity
- moderate political importance

PCAT 5 policies have the following characteristics:

- $\circ$  low levels of emergence
- o low internal system complexity
- low external system complexity
- o low political importance

PCAT uses the following assessment criteria to categorize policies:

	Assessment Criteria
А	Level of Emergence
	The policy is a journey that is driven by a vision. The policy has emergent properties that cannot be predicted and emerge through the policy whilst in
	operation.
В	Internal Policy Complexity
	Measures the complexity of the delivery organization, the extent the policy will use
	a systems-of-systems strategy, the complexity and maturity of the technology, and
	complexity of the policy design, implementation, and delivery process.
С	External Policy Complexity
	Measures the stakeholder complexity, the maturity of the policy's external
	environment, and the expectations from the policy.
D	Importance
	Measures the political importance and cost of the policy.

The Policy Categorization tool combines contemporary research into complex policy and the criteria used in the defense sector for categorization.

	Policy Categorization	
Internal policy	Delivery organization	High capability / low capability
complexity System-of-systems complexity		
	Technical complexity	Complex /simple
	Commercial complexity	
Emergence	Strategic emergence	Scope for adaption / Right first time
	Cultural change	Divergence tolerated / Uniformity demanded
External policy	Stakeholder complexity	
complexity	Maturity of external environment	Complex / simple
	Schedule complexity	
Importance	Strategic importance	

#### **PCAT Scoring and Categorization Summary**

Each of the four assessment criteria has multiple sections:

- Internal Policy Complexity:
  - Delivery organization
  - Systems-of-systems complexity
  - Technical complexity
  - o Design, implementation, and delivery complexity
- Emergence:
  - Strategic emergence
  - Organizational emergence
  - 0
- External Policy Complexity:
  - Stakeholder complexity
  - Maturity of policy's external environment
  - Expectations
- Importance:
  - Strategic importance
  - Policy cost

Each of these sub-sections has multiple assessment questions. The PCAT Tool rates each of these questions for importance (from zero for low importance, to 10 for high importance). Individual governments can alter the rating of the questions.

The first step in categorizing a policy is to assess the policy by scoring each question. Each question is scored between low and high.

Low		Moderate		Moderate		Hig	jh 🛛	
$\odot$	0	0	0	0	$\bigcirc$	0		
•	0	0	0	0	0	0		
0	0	0	0	$\overline{\mathbf{O}}$	0	0		
0	0	•	0	0	0	0		
0	0	0	$\odot$	0	0	0		
0	0	0	0	0	0	$\overline{\mathbf{O}}$		

**PCAT Categorisation** 

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The PCAT Tool calculates a score for each of the four criteria, an overall score for the policy, and categorizes the policy into one of five categories.

# Dolicy Name: Date: insert here insert here Assessor: Complex Name: insert here Position: insert here

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Area of Po	licy Assessment	Score	Remarks	
AREA 1:	INTERNAL POLICY COMPLEXITY	30.00	PCAT IV	
AREA 2:	EMERGENCE	51.19	PCAT III	
AREA 3:	EXTERNAL POLICY COMPLEXITY	30.00	PCAT IV	
AREA 4:	IMPORTANCE	100.00	PCATI	

PCAT III

#### **Policy Assessment**



### 7. Complex Policy – a journey

Is the policy so complex that it is better for the agents to address it through adaptation, rather than through the policy owner trying to specify a solution in advance?

The realization of complex policies is best viewed as a journey. As shown, the journey is non-linear and recursive, with Process Governance, WAVE Planning, and Stewardship managing the emergent journey.



Complex policies are often unfamiliar and emergent, and there is often little agreement on what the policy should look like, let alone how the policy can be realized (sustainability, crime, jobs, health, energy, etc.).

From a risk perspective there is a strong case for letting the multiple agents in the adaptive systems-of-systems handle the complexity, rather than the policy owner trying to specify a solution in advance.

Policy owners are therefore better off to establish high-level goals and delivery solutions that can both be progressively adapted to an emergent world. For example, technical oriented policies are better implemented using new technologies strategically and leveraging off legacy technologies rather than implementing a full replacement of all legacy technologies. Through using an emergent strategy, the policy can assess the effectiveness of the inserted technology, and then progressively review new technologies for insertion.



Complex policies are very difficult, if not impossible, to fully design in advance.

Because of: the high level of emergence; the policy owners' lack of directive control over implementation; and multiple delivery agents; it is difficult to standardize policy outcomes. Complex policy is not just made and then executed: as shown above, it is made and constantly re-made by multiple players throughout the system as many multiple agents working together in a systems-of-systems often adapt the outcomes of policies.

Therefore policy owners need to:

- $\circ~$  design complex policies to have high-level goals that are resilient to the level of emergence that is likely to occur.
- o establish a governance system:
  - where the implementation and delivery strategy is purposefully designed to have a major role in shaping the policy over its lifecycle;
  - to oversee the ways in which the policy is being adapted by the multiple agents, and to enable the policy owner to steer the systemsof-systems towards the policy owner's high-level goals.

Given the need for flexibility of the policy systems, effective decision-making needs to adapt as new information becomes available – and much of that information will come from the process of decisionmaking itself. Therefore, those implementing and delivering a policy need to have authority devolved to provide them with the capacity and opportunity to adapt it to local or changing circumstances.

Thus, governance involves policy owners devolving responsibility for local implementation and delivery to agents, and overseeing how the policy is being adapted, and attempting to steer the system if it is



deviating too far away from the high level goals of the policy. Depending upon the degree of control the policy owner has over the agents, different governance processes are needed:

- Directive Where the policy owner has directive control over the agents, a governance system developed for defense programs called Integrated Process and Product Development (IPPD) can be adapted. The IPPD system establishes a formal governance structure and integrated operational teams.
- Participative / Consultative Where the policy owner does not have directive control over the agents, the policy owner must rely on establishing a cooperative / participative based governance system. The Process Governance system developed for complex programs provides a proven governance system. Process Governance includes a process system that manages emergence, and incorporates the Integrated Teams component of IPPD, and Partnering.

Regardless of the Control system used, the policy owner needs to establish a suitable strategy and capability for policy journey management (design, implementation, delivery, and emergence).

### 8. Systems-of-Systems

A systems-of-systems is defined as a set or arrangement of component systems that results when independent and useful component systems are integrated into a larger system that delivers unique capabilities.



Policy systems-of-systems are loose-coupled systems where autonomous component policies are brought together to deliver a high order goal, while the autonomous component policies continue to deliver their own specific goals. Distributed ownership of individual components represents a risk problem for any systems-of-systems. Because the systems-of-systems policy owner does not control the component policies, governance becomes significantly more complicated and must change to accommodate the realities of a systems-of-systems. Many different organizations own pieces of the systems-of-systems, yet it is unlikely that a single organization will own the entire systems-of-systems. Without an overall systems-of-systems governance policy, it is likely that the individual component policy owners will develop policies according to their localized priorities, resulting in negative effects on the systems-of-systems.

To enable policy systems-of-systems to deliver unique goals, the complex policy owner establishes an umbrella system to enable the component policies to work together. This bringing together of the component policies is done through establishing a shell that allows a 'plug-and-play' approach with the component policies being added, changed, and removed as required, and remaining effectively unchanged - the systems-of-systems strategy does not attempt to fully integrate the component policies.

Policy systems-of-systems introduces a new set of issues that have significant implications for governance. The following list of characteristics captures the essence of how a policy systems-of-systems differs from a stand-alone policy:

- o Operational independence of the systems Each system within a systems-ofsystems has a "life of its own" and can function effectively and provide useful service without necessarily interacting with other policies.
- Managerial independence of the systems The individual policies within a systems-of-systems are under different authorities.
- o Evolutionary development The different policies within the systems-ofsystems are developed and upgraded on uncoordinated schedules.

Not all systems-of-systems will exhibit all of the characteristics, but it is generally assumed that a systems-of-systems is characterized by exhibiting these key characteristics. Although the individual systems in a systems-of-systems are usually considered to have independent operational viability, it is sometimes the case that the systems-of-systems must contain some systems the only purpose of which is to enable the interoperation of the other component systems. That is, the enabling systems cannot operate outside of the systems-of-systems.

The key aspects for structuring of a systems-of-systems for complex policies are:

- o establish an umbrella enabling system that supports the interoperation of the legacy policies;
- o establish process governance to plan and coordinate interoperability and emergent change across the systems-of-systems component policies and systems;
- $\circ$  establish a shell structure to enable a 'Plug and Play" approach where component policies can be removed, changed, or added;
- o include legacy policies and new policy components:
- change may need to be made in component policies to enable them to effectively operate as a component in a Policy systems-of-systems; and
- establish a capability for Policy systems-of-systems rapid fielding and 0 emergence. The traditional enterprise capability is based on a sequential model that is not suited to today's emergent world or complex systems-ofsystems. Process Governance, WAVE Planning, and Stewardship provide the rapid and agile capability needed for complex Policy systems-of-systems.

#### **Types of Policy Systems-Of-Systems**

Policy systems-of-systems can take different forms - there are four types of policy systems-of-systems:

• **Directed.** Directed Policy systems-of-systems are those in which the systemof-systems is created and managed to fulfill specific policy goals and the constituent policies are subordinated to the policy systems-of-systems. The component policies maintain an ability to operate independently, but their normal operational mode is subordinated to the central managed policy systems-of-systems goals.

- Acknowledged. Acknowledged Policy systems-of-systems have recognized goals, a designated policy owner, and dedicated resources for the policy systems-of-systems; however, the constituent policies retain their independent ownership, objectives, funding, and development and sustainment approaches. Changes in the policy systems-of-systems are based on cooperative agreements between the policy systems-of-systems owner and the component policy owners.
- Collaborative. In Collaborative Policy systems-of-systems the component policies interact more or less voluntarily to fulfill agreed upon central purposes. The central players collectively decide how to provide or deny service, thereby providing some means of enforcing and maintaining standards.
- Virtual. Virtual Policy systems-of-systems lack a central management authority and a centrally agreed upon purpose for the system-of-systems. Large-scale behavior emerges – and may be desirable – but this type of systems-of-systems must rely on relatively invisible mechanisms to maintain it.

In government today there is a need for acknowledged policy systems-of-systems to deal with complex policy issues including multi-jurisdiction policies. Like directed policy systems-of-systems, acknowledged policy systems-of-systems have recognized authorities and resources at the systems-of-systems level. However, because an acknowledged policy systems-of-systems comprises policies that maintain independent objectives, management, and resources, along with independent development processes, these policy systems-of-systems are largely collaborative in practice. For policies in these systems-of-systems, in particular, their normal operational mode is not subordinated to the policy owner (which is a distinct feature of a directed policy systems-of-systems).

Government policies and funding are still largely ministry focused and many policy systems-of-systems do not have authority over the component policies. Typically they try to address policy systems-of-systems objectives by leveraging the developments of the component policies, which are normally more long-standing and better supported than the policy systems-of-systems. Consequently, acknowledged policy systems-of-systems, like directed policy systems-of-systems, have objectives, management, and funding without authority over the component policies. Like collaborative policy systems-of-systems, changes in component policies to meet policy systems-of-systems needs are based on agreement and collaboration, not top-down authority from the policy systems-of-systems owner.

# 9. Stewardship and Process Governance

Stewardship is now generally recognized as the acceptance or assignment of responsibility to shepherd and safeguard the valuables of others.

Complex policies are emergent, use systems-of-systems as their structure, and involve multiple independent component policy owners and agents working together to deliver high goals. Therefore, governance for systems-of-systems is difficult to design and manage. While the policy systems-of-systems owner establishes high-level goals, the component policy owners and agents cannot be made to adhere to any individual set of goals and rules that are defined. In fact, there may be many component policy owners and agents with a variety of different and, perhaps, competing goals.

Developing stewardship within the policy owner, the component policy owners and agents is a critical aspect for the journey management of complex policies.

Stewardship is operationalized through process governance and WAVE Planning. Complex policies are not just 'complex systems' bounded by the fixed rules of interaction between their parts. Rather they are 'complex evolving systems' that can change the rules of their development as they evolve over time.



Process governance provides the stewardship that drives the journey, holds the policy systems-of-systems focused upon the emergent policy goals, and supports an emergent strategy (as opposed to maintaining the status quo). Throughout the journey, process governance maintains the strategic focus for the policy as the stakeholders' views inevitably change. Process governance proactively uses double loop learning to deal with changes to stakeholder views, and thereby maintains stakeholder alignment, commitment, and stewardship. Through process governance, multiple, often opposing views, are accommodated, and the policy systems-of-systems owner is provided with genuine control.

When developing a single, stand-alone policy, the policy owner has directive control and authority within their organizations and can effectively enforce governance over the components they own. Even when multiple organizations are involved, the policy owner must have directive authority through the cabinet or through the department's control over the agencies in a hierarchical manner. Policy ownership of a systems-ofsystems is a complex matter, with no single organization being in any position of ownership (and by extension authority) over the whole. Governance is about control, and the issue is how can control be established across systems-of-systems that have distributed ownership? If control is essential to the effective policy systems-ofsystems realization, then without sufficient control what will encourage independent organizations to adopt shared goals? It is difficult to establish control over a large systems-of-systems precisely because no individual or organization can have total authority – even when it appears that a single authority does exist. For example, a department may create a systems-ofsystems with authority for the integration of constituent policies into a systems-ofsystems. Theoretically, this new systems-of-systems has some authority over the constituent policies and their associated stakeholders. However, in instances like that, the owners of the constituent policies and systems inevitably have primary allegiance to their particular stakeholders. Even if owners of constituent policies and systems are unusually committed to the systems-of-systems, a single authority is likely to be ineffective since the size of the overall capability makes it virtually impossible to understand the nuances involved in effective control. Thus, the only alternative is to facilitate collaborative identification and adherence to a shared set of governance processes.

Collaborative system-of-systems governance involves abandoning the notion of rigid top-down governance of processes, standards, and procedures, and adopting peerto-peer approaches such as Integrated Process Teams, Partnering and Connective Planning. Such collaborative system-of-systems governance is clearly at odds with the natural tendency of government, because it means that the "chain of command" must evolve to a "web of shared interest." Collaborative system-of-systems governance requires cooperation between separate authorities and agents, even when there is no formal agreement.

The characteristics of collaborative governance for systems-of-systems are:

- independent systems-of-systems facilitation new responsibilities are needed for policy systems-of-systems owners to act as conveners, and to engage external facilitators to co-ordinate the policy systems-of-systems establishment and ongoing development.
- identifying scope of shared goals understanding each party's goals and agree and document areas where shared goals can exist and areas where shared goals cannot exist. There will be legitimate goal, motivation and accountability differences. These differences need to be recognized, respected, and understood.
- incentives for co-operation where there is not directive control, policy systems-of-systems owners need to establish incentive processes to motivate component policy owners and agents to participate co-operatively. Incentive based motivation is most easily achieved with private sector agents where the incentive is linked to Key Performance Indicators.
- agreeing shared values the parties agree and document the values that they will collaboratively work with. The values and agreed shared goals are documented in a charter against which cooperation is measured.
- a problem-solving orientation a formal process to identify and prioritize both problems and opportunities and to develop tangible action plans. The problem solving process is repeated periodically.

- participation by interested and affected parties in all stages of the decision-making processes – partnering and the use of integrated policy teams establish democratic processes that facilitate effective problem solving and buy-in.
- provisional solutions complex policies are recognized as being subject to ongoing revision, which requires willingness to move forward under conditions of uncertainty and to reconsider goals and solutions:
  - Evolution of the component policies A fundamental characteristic of a systems-of-systems is that its component systems will change at different rates and in an uncoordinated manner. At a minimum, governance for evolution should include rules and guidelines for:
    - informing other component policy owners and agents of the changes in the interfaces to and functionality of one policy.
    - coordinating schedules with component policy owners so that those that have to change can do so together (when backward compatibility of interfaces cannot be maintained).
    - developing each policy to insulate it from changes in other component policies.
    - Minimizing the impact to interfaces when changing a component policy.
  - Evolution of the systems-of-systems itself While evolution of the systems-of-systems may be directed, it will also occur, by default, when new component policies are added. If policies are simply added to the systems-of-systems without forethought, sooner or later the unanticipated interactions between the various policies will create behaviors that are unanticipated and undesirable. Test and Evaluation methodologies are needed to evaluate systems-of-systems establishment and evolution.
  - WAVE Planning provides a methodology to manage complex policy realization.
- back to zero policies are based on assumptions and driven by views (subject to bounded rationality). The WAVE Planning methodology uses double loop learning to periodically reassess the policy against changed assumptions and views.
- **accountability** traditional top-down oversight may be supplemented or replaced by self-disclosure and shared monitoring.
- avoiding problems coordination problems can occur at multiple levels with the parties. An escalation ladder is established to expediently resolve issues at the lowest level, and to rapidly escalate problems if they cannot be solved at lower levels.

### 10. WAVE Planning

WAVE Planning provides a readily understood methodology for the realization (planning, implementation, delivery, and emergent management) of complex policy systems-of-systems.

Complex policy systems-of-systems are non-linear and recursive in their realization and cannot be planned or managed using traditional linear based strategic formulation planning and project management tools.

The US Department of Defense has developed a model for the development and management of systems-of-systems. The US model has seven elements:

- 1. Translating goals in policy
- 2. Understanding systems
- 3. Assessing performance against goals
- 4. Monitoring change
- 5. Developing and assessing SoS Architecture
- 6. Assessing requirements and policy options
- 7. Orchestrating upgrades



WAVE Mode: developed by Dr David Dombkins

THE US Department of Defense has harnessed WAVE Planning to enable the seven- element model to be viewed as a model that looks linear, while incorporating the non-linear and recursive patterns that are characteristic of complex systems-of-systems policies.

WAVE Planning is the core to the realization of complex policies and is integrated into process governance to establish stewardship.

Key political benefits from WAVE Planning are:

- o Clear high level goals are established;
- o Short term deliverables are defined and delivered using traditional approaches;
- $\circ$  The WAVE Planning cycle fits with the annual political budget cycle; and
- Significant cost savings can be delivered by systems-of-systems through optimizing leverage of legacy policies and systems.

### **11. Integrated Policy Teams**

Integrated Policy Teams is a management methodology that integrates all activities from policy concept through design, delivery, implementation, and emergence development, using a multifunctional team, to simultaneously optimize the policy realization and to meet cost and performance constraints.



The model for Integrated Teams was first developed by the US Military for the concurrent development of operational processes and products. In dealing with complex policy systems-of-systems, integrated teams:

- provide a structural design for bringing the multiple component policy owners and agents together to design, realize, and manage the emergent policy systems-of-systems;
- operate at the steering, design, management, implementation, services delivery, compliance, technical, and functional levels;
- $\circ\;$  are structured to respect the individual goals of the component policy owners and agents; and
- $\circ$  use partnering and connective planning as supportive processes.

# 12. Complex Policy – Rules of the Road

- Complex Policy objectives are defined in high-level goals that can remain relevant over time.
- Do not define the policy detail beyond the certainty horizon.
- Use multiple systems thinking methodologies to develop a holistic understanding of the policy. These multiple systems thinking methodologies will provide different views that are often contradictory.
- Emergent behavior occurs in complex policies where unexpected outcomes occur that cannot be predicted by knowledge of the policy's constituent parts. "Unexpected" means unintentional, not purposely or consciously designed-in, not known in advance, or surprising to the developers and users of the policy.
- The emergent outcomes of a complex policy can result from either the internal relationships among the component part of the complex policy or as a response to its external environment.
- Complex policies bring together multiple component policies to deliver a higher order goal.
- Complex policies establish systems the only purpose of which is to enable the interoperation of the other component policies.
- Complex policy owners need agents outside of their direct control to develop and deliver complex policies. These agents will adapt policy deliver solutions to their purpose and local conditions that will change through emergence over time.
- Complex program owners operate in an environment where they do not control all of the component policies or agents that impact the policy, and stakeholders have interests beyond the complex policy's objectives.
- Complex policy owners must balance the complex policy needs and goals with individual component policy owners and agents needs and goals.
- Policy design, implementation, and delivery must consider and leverage the development plans of the individual systems and establish a governance system to manage change.
- Must address the end-to-end behavior of the ensemble of component policies, addressing the key issues that affect that behavior.
- Focuses primarily on the end-to-end behavior of the complex policy and addresses the constituent systems only from that perspective.
- Use right to left thinking.
- Use a policy design based on open systems and loose coupling to support the addition or removal of component policies, and ongoing emergence.

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