Exploring the Definition of Adaptive Policies

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Designing Policies that can Adapt to a World of
Uncertainty, Change and Surprise:
Adaptive Policymaking for Agriculture and Water Resources

Project Partners:
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1. Introduction

We start with the observation that our economic, social and ecological systems are so complex and interconnected that we simply can not fully comprehend how the overall system will respond to new and unanticipated conditions. With surprise, change and uncertainty a continual reality, the ability to deal with unanticipated conditions is imperative. Public policies that are designed (implicitly or explicitly) to operate within a certain range of conditions are often faced with conditions from outside of that range. This can have serious results in all of the sustainable development spheres – the economy, the environment, and human well being.

This concept paper is the first output of the joint IISD-TERI-IDRC project on "*Designing Policies that can Adapt to a World of Uncertainty, Change and Surprise: Adaptive Policymaking for Agriculture and Water Resources*." The first draft of this concept paper was designed to provide a foundation for an initial understanding of the concept of adaptive policies to be discussed and clarified at the project's inception meeting in New Delhi in June 2005. While this understanding will inherently evolve as the project progresses, an initial shared understanding will help to clarify terminology, vocabulary and key issues of relevance for the various research tasks to be undertaken during the four-year life of the project. The current version of the paper has been amended to reflect the discussion that took place at the Delhi meeting.

1.1. Project Overview

The underlying premise for this international joint project is that the adaptive capacity and resilience of communities to surprises and longer-term change is a critical aspect in the transition to sustainable development, and an important factor in building adaptive and resilient communities is for the ***public policies***, which influence the behaviour of communities, to themselves be adaptive and resilient to uncertainty, change and surprise. ***The purpose of this project is therefore, to advance the emerging concept of adaptive policies and therefore, contribute to building the adaptive capacity and resilience of communities.***

The specific objectives of this project are to help government agriculture and water resource development policymakers at the local, provincial and federal levels to design adaptive policies. These are policies that are robust across a variety of possible futures, rather than optimized for a specific future; and have the ability to adapt to circumstances as they emerge over time. While uncertainty, change and surprise come in many forms and are a reality for all sectors, this project will focus on the physical and socio-economic uncertainties, changes and surprises resulting from climate change.

This project seeks to fill a gap in the practical and conceptual knowledge about the design of public policies. In the paper below, we briefly outline the analytical framework that we are starting with. The project methodology is to undertake a series of case studies in both India and Canada, and then use the cases to refine or change the starting framework. We hope that by

choosing case studies in two different countries, and learning from each study in order to define the next one, we can uncover practical examples of adaptive instruments. We will then use this to develop a framework that will be of use to policy design practitioners.

1.2. Why Study Adaptive Policies?

Agricultural producers and pastoralists have a long history of adapting to uncertainty, change and surprise. Climatic variability is one example, whether it be surprises in the form of floods or stresses such as prolonged droughts. The current climate change phenomenon is projected to exacerbate these surprises and stresses, and is expected to result in longer-term changes in our average precipitation and evaporation. Building the capacity to adapt such conditions is a critical step in helping those relying on agriculture and water resources to sustain their livelihoods – or in other words, to become resilient to the surprises and longer-term changes that are anticipated.

Public policies and institutions have been developed in the past to facilitate this ability to adapt to climate variability and change (e.g., the Prairie Farm Rehabilitation Administration in Canada). Adaptation priorities in the face of future climate variability and change, and the specific policies required to help facilitate these adaptations are the focus of a significant and growing body of pragmatic research around the world. But what if the policies themselves cannot adapt to the unanticipated circumstances which inevitably emerge over time, circumstances which invalidate many of the core assumptions upon which the policy operates? Such policies could become a hindrance or a constraint on the ability of individuals and communities to adapt. Unfortunately, this is a situation which has become all too common in today's increasingly interconnected and rapidly changing world, and a growing body of research is pointing toward the need for adaptive approaches to policymaking.

For example, in India and Nepal a group of researchers studying water governance in an IDRC-funded project found that "when situations are characterized by variability, uncertainty and change, conventional planning scenarios provide little guidance regarding future needs and conditions" (Moench et al. 2003). The research revealed that although it might be possible to identify some emerging issues with conventional approaches, it is the case that "changing conditions often render specifically targeted management proposals irrelevant or impossible to implement." The authors concluded that there is a "clear need for frameworks that are adaptive – which reflect uncertainties and can respond as contexts change or unforeseen problems emerge." Specific insights toward better management approaches were gleaned from their water governance research, including:

- "specific solutions are less important than the existence of processes and frameworks that enable solutions to be identified and implemented as specific constraints and contexts change;
- In most situations more attention needs to be given to clumsy, resilient institutions and approaches rather than tightly focused (theoretically efficient) but brittle ones. Tightly focused institutions and organizations are essential for specific tasks – but they can't govern or guide the complex, surprise laden, process of water

> governance central to long-term management at a regional, basin, aquifer or even local level.

Along similar lines of thought, Scoones (2004) points out that much can be learned from the pastoral rangelands of the world where uncertainty has always been a part of everyday life and survival. He describes these as regions "where systems are not at equilibrium, where sometimes chaotic, often stochastic, dynamics prevail and where predictability and control are false hopes." These types of regions are described by Ellis (1998) as existing in very large swathes of Africa, where the coefficient of variation of rainfall is more than 30%.

Scoones (2004) recognized that if climatic uncertainty and variability are on the rise due to climate change – then "we must shed our blinkered equilibrium views and solutions and search for alternatives that allow for living with uncertainty." He compiled the views of a number of authors regarding the implications of taking a non-equilibrium view, and the results were considered startling in that the standard way of thinking about a range of policy issues had to be radically rethought. Conventional views of institutions as static, rule-based, formal, fixed, and having clear boundaries are giving way to views that institutions must be dynamic, overlapping, heterogeneous, socially defined, emergent from adaptive practice, and flexible. Similarly, development planning which traditionally has taken a blueprint approach and used linear policy models, are giving way to views of development as characterized by adaptive planning and policies that are flexible, responsive, learning, non-linear, and discretionary.

Uncertainty, change and surprise are not seen only in relation to agriculture and water resources. The need for adaptive approaches in policymaking spans all aspects of development. Policy researchers in the Netherlands were faced with the tangled issue of national civil aviation policy, and most specifically, whether to accommodate increased volume at the Schiphol Airport (Walker et al. 2001). A host of uncertainties surrounded the issue of accommodating projected airport use such as other governments subsidizing inefficient carriers giving unfair competitive advantage, other airports increasing their capacity, and airlines changing their hub location. The authors highlight the uncertainties involved, saying that if they were able to predict the future accurately, they could simply identify preferred policies by examining the future that would follow from the implementation of each possible policy and pick the one that "produced the most favourable outcomes." However, the inherent problem with this approach is fundamentally that "for most systems of interest today (particularly social and economic systems), such prediction is not possible, due to increasing complexity, their increasing interrelationships with other systems, and the increasing uncertainty of development external to the system that have important effects on the system" (Walker and Marchau 2003).

Our current project aims to fill a significant gap in the research regarding public policy design in a world of uncertainty, surprise and change. How can policies be designed and implemented so as to react well to changing circumstances, rather than break down in the face of unforeseen challenges? The fundamental issue is that change, rather than

stability, is becoming the norm for all countries. Changes in climate are one dimension of this, but rapid shifts in trade, investment, competitiveness, environmental degradation, resource use are also common.

All of these situations start from a recognition that policy systems and policy change are not linear, rational or deterministic processes. There is typically no clear causal chain to explain how a particular policy either takes shape or fails. Policies are the outcomes of iterative and opportunistic interaction among multiple factors which include perception of problems among different groups, communication of new knowledge and consensus on its validity, argument, contestation, power and political opportunity.

2. Literature Review: Understanding adaptive policy

Adaptive policies are likely to be more robust, and implemented so as to react well to changing circumstances, rather than break down in the face of unexpected change, unforeseen challenges. What does policy adaptation imply? One can imagine, in one case, a policy framework which needs little adjustment to cope with new circumstances. These kinds of policies could have characteristics analogous to natural systems, which have the capacity to adapt to perturbations, so we can explore what they might look like by reference to natural science analogues. Another situation would be one in which the core elements of policies may persist under stress, but the ways in which policy is implemented must change in order to meet unexpected conditions. How can policy implementation be adapted effectively? We also want to consider circumstances in which policies are fundamentally untenable due to changing external conditions and must be completely overhauled. Policies in these circumstances will have exceeded their adaptive capacity, but an adaptive policy *system* should quickly learn how to diagnose and respond to the new context.

The intent of this literature review is to explore concepts of relevance for advancing our understanding of adaptive policies in the context of this project. In the course of doing so we endeavour to address two questions:

- what do we mean by "adaptive".
- what do we mean by "policies",

We begin in this section by focusing on literature which explicitly mentions the terminology of adaptive policies or policymaking. We next turn our attention to policy instruments in terms of a typology of instrument types – to better position us to discuss what should be in or out of scope for this project – and in terms of examples of policy instruments that portray adaptive characteristics. These examples are meant as an initial illustrative list. A more detailed review of adaptive-like policies in India and Canada related to water and agriculture will be undertaken by IISD and TERI and featured in the second project paper. The literature review necessarily engages in some divergent thinking in order to develop some peripheral vision – to look for insights on adaptive policymaking from sources of literature which we perceived to be related to the concept of adaptive policymaking.

In Section 3 review we extract the key insights from this literature review and put forth ideas for working definitions of adaptive policies and other key terms for this project. It will be these ideas for working definitions in Section 3 that will form the basis for discussion during the project's inception meeting in New Delhi.

2.1. Insights from the Adaptive Policymaking Literature

Some of the first hints toward adaptive policymaking actually came early in the 1900s. Dewey (1927) put forth an argument proposing that "policies be treated as experiments,

with the aim of promoting continual learning and adaptation in response to experience over time." (in Busenburg 2001) Over sixty years later Kai Lee appears to be one of the first to use the term "adaptive policy" in his account of integrating science and politics in the highly contested issue of salmon fisheries restoration and hydropower development in the pacific northwest of the United States. Lee describes *adaptive policy* as ***a policy that is "designed from the outset to test clearly formulated hypotheses about the behaviour of an ecosystem being changed by human use***." (Lee 1993)

Walker and Marchau (2003) in a special issue of the international journal *Integrated Assessment* give direct focus to the terms adaptive policies, policy analysis, and policymaking and take them to a more pragmatic level. They suggest that **policies be *"adaptive – devised not to be optimal for a best estimate future, but robust across a range of futures***." They go on to describe that such policies "should combine actions that are time urgent with those that make important commitments to shape the future and those that preserve the needed flexibility for the future." Their notion of adaptive policies are policies ***that respond to changes over time and that make explicit provision for learning.*** This approach requires that **learning and adaptation of the policy be made *explicit at the outset* and the inevitable *policy changes become part of a larger, recognized process and are not forced to be made repeatedly on an ad hoc basis*** (Walker and Marchau 2003).

The adaptive policy-making process as articulated by Walker et al. (2001) begins with *stage setting* and *assembling basic policy* steps, while the remaining parts articulate the critical learning loop processes (Figure 1). Some of the innovative steps of their adaptive policy-making process include:

- *Separate actions now from those that can or should be deferred* until more information becomes available
- Develop indicators such as *signposts for monitoring changes* and identify thresholds or *triggers for contingency plans*
- *Establish limits to the validity of the analysis*, that once violated, should lead to reassessment of the policy.

The basic building blocks and tools of their adaptive policymaking approach include:

- *Basic policy* – one or more options and plans for implementation
- *Vulnerabilities* – potential adverse consequences associated with the policy or side-effects of the policy.
- *mitigating actions and hedging actions* taken in advance to reduce risk of certain and possible adverse effects of a policy
- *Signposts* – information that should be tracked in order to determine whether defensive or corrective actions or a policy reassessment is needed
- *Triggers* – critical values of the signpost variables that lead to implementation of defensive or corrective actions or to a policy reassessment
- *Defensive actions* taken after the fact to preserve a policy's benefits, *corrective actions* to adjust the basic policy in response to triggers, *or reassessment* when the policy has lost validity.

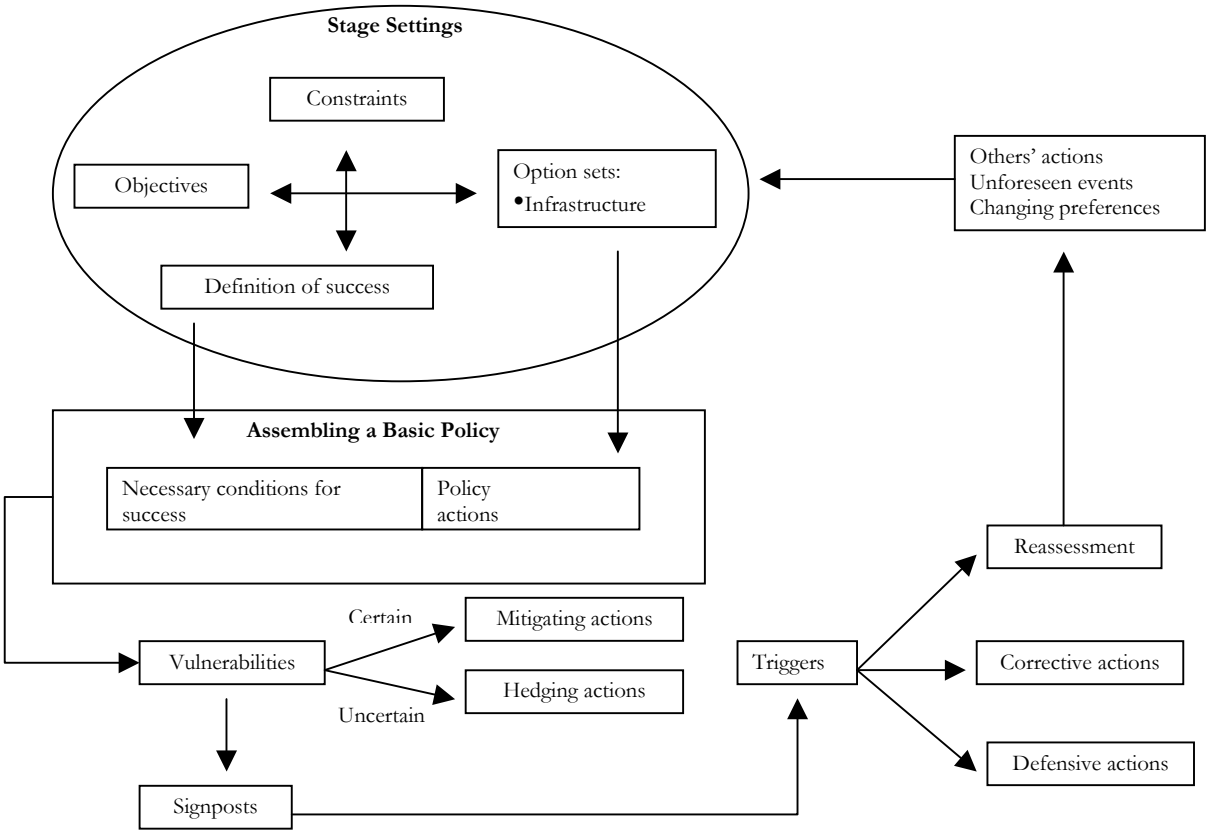

Figure 1 – Adaptive policymaking framework proposed by Walker et al. (2001)

The terminology of adaptive policy makes an appearance in the U.S. National Academy of Science literature in 2002 in relation to agent-based modelling. Bankes (2002) proposed refinements in agent-based modelling approaches in recognition that "most policy problems involve complex and adaptive systems, and that for those problems the classical approaches of predictive modeling and optimization that have been used in decision support software are not appropriate." Bankes contends that for policies to be successful in a complex and adaptive world, policies will "need to be adaptive themselves", and warns that relying on optimization techniques to develop policies based on the projections of a single model will produce static policies which make the "correct move" for the best estimate model. Alternatively, he believes "***adaptive policies*** need to be evaluated on their ***robustness*** properties, not on their performance on any single case." Used properly, Bankes suggests that computers can be used to "discover policies that are robust across multiple scenarios or alternative models, and to identify and graphically depict sets of policies with satisfactory robustness." He concludes that computers can be used to:

> *"… find important scenarios by searching through such ensembles, in particular to find cases that break a proposed policy. Such worst cases can* ***stimulate users to modify the***

> ***range of possible policies*** *to allow for combinations that* ***hedge*** *against these possibilities. This strategy can allow users to iterate with the computer to gradually* ***evolve policy schemas that have particular policy instances with desirable properties****. This approach has been successfully used in several studies to make concrete policy recommendations for deeply uncertain problems by using very nonlinear simulations including agent based."*

Ruitenbeek and Cartier (2001) make an indirect connection to adaptive policies in presenting a continuum of policy instruments in terms of flexibility and government involvement and discussing them in relation to complex adaptive systems. On one end of the continuum are instruments with minimum flexibility, maximum government involvement and described as control oriented. On the other end is maximum flexibility, increased private initiative and litigation oriented instruments. In between lie the market oriented instruments. The authors note that virtually any instrument along this continuum could be appropriate in a complex adaptive system, but that this would depend on the nature of the system. The authors cite an example of "if functioning social institutions are in place, decentralized instruments requiring little government involvement may be a good policy choice. Conversely, imposing strong external regulations within such a context could disrupt any positive natural evolution that might occur."

2.2. Insights from Policy Instrument Types

What exactly are we referring to with the term "policy?" A conceptualization of the different types of policy instruments that governments use to influence behaviour is beneficial in this project for advancing toward a shared understanding of adaptive policies. For sake of analysis, policy instruments can be placed into four broad categories (from IISD and TERI 2003):

- Economic instruments;
- Direct expenditure instruments;
- Regulatory instruments; and
- Institutional instruments.

Economic instruments refer to measures that directly influence the price that a producer or consumer pays for a product or activity. Economic instruments also include market-based instruments or financial incentives. Specific economic instruments include tradable permits, deposit refunds, performance bonds, taxes, user fees, subsidies, tax breaks, earmarked taxes and funds, and administered prices.

Regarding ***direct expenditure instruments***, governments influence producer and consumer behaviour through channelling expenditures directly at the behaviour they want to encourage (Barg et al. 2003). This category of instruments is characterized by broad programmes of expenditures targeted at a macro level to foster activities such as technological innovation. Specific instruments of direct expenditure include the very wide range of program expenditures that governments make as well as some particular cases like green procurement, research and development, and moral suasion.

Regulatory instruments describe efforts to create change via legal avenues. Several different regulatory instruments fall under this category including legislation, liability, enforcement activity, and competition and deregulation policy instruments. Legislative instruments involve the acts and regulations that a government passes to create a legal mandate for change. Enforcement instruments are considered separately in that there could be a legislative requirement and no enforcement – the combination of course, leads to an ineffective legislative instrument. These instruments aim to induce socially responsible behaviour by establishing legal liability for certain activities such as natural resource damage, environmental damage, property damage, damage to human health, non-compliance with environmental laws and regulations, and non-payment of due taxes, fees or charges (Panayotou 1998, p. 41). Competition and deregulation policy initiatives are directed at orienting markets such that "prices are established and investments are made in competitive and freely functioning competitive markets." (NRCan 2002)

Institutional instruments affect the workings of the government itself in an effort to promote change. Included in this category are internal education efforts and internal policies and procedures. Efforts such as the National Round Table on the Environment and the Economy in Canada are often initiated to educate government decision-makers and the policy community on issues. Internal policies and procedures act to change the way governments go about making and implementing decisions. For example, Canada's Office of the Auditor General includes a Commissioner of Environment and Sustainable Development with a mandate of overseeing the drafting of sustainable development strategies by all federal governmental departments.

For each of these categories we provide an illustrative listing of policy instruments which appear to portray adaptive characteristics. It is the case, however, that any class of instruments can be made more or less adaptive, through the details of its design. Therefore in what follows we are not categorizing the above list of instruments into adaptive vs. non-adaptive groups, but rather we wish to illustrate how instruments in each category can be adaptive. These examples will help us later define the characteristics of adaptive instruments, no matter what the category.

2.2.1. Economic Instruments

One of the most important economic instruments is the income tax system, both personal and corporate. In Canada, this system is very large and complex, with legislation, regulations and government policies covering many thousands of pages. The system is administered by two separate departments of the federal government (Finance makes the policy, and the Canadian Revenue Agency operates the assessment and collection system), and even has its own court (not surprisingly, named the Tax Court of Canada).

This complex system has a great deal of flexibility built into it, in the sense that it is designed to deal with a very wide range of situations. It contains many provisions that are designed to accomplish environmental, social and economic goals, as well as fulfilling its basic mandate of raising money in a way that is intended to be fair and equitable. However, one of its principle goals is that of "certainty", meaning that a

taxpayer should know as clearly as possible what his liability will be. This goal is met by making the rules as detailed and explicit as possible. The court system is there in part to help make what is found to be unclear, more explicit and rigid. As a result, capacity to adapt to new and unforeseen circumstances is very limited. But the capacity is not entirely absent, in a couple of ways:

- There is a set of formal and informal advisory mechanisms whereby the government receives advice as to changes that should be made to keep the system working
- Since there are amendments to the legislation every year, there is a regular opportunity to make changes and (to some degree) an ongoing review of the possibilities.

Another key economic instrument is the creation of markets, such as the market for SO_2 created in the USA or the international market for carbon credits created by the Kyoto Protocol. While markets are normally created through the use of regulations, they properly fit in the economic instrument category because they provide cost signals that affect economic decision making. Markets are very flexible instruments because they provide price signals but leave decisions up to the individual or company. Thus the decision can be made taking many issues into account, and as those issues change, the decision maker can react flexibly. On the other hand, markets may be defined so as to offer flexibility only on narrow issues. An example is a market for water rights that only allow the rights to be traded within the basin and to other rights holders. While this may lead to economically efficient allocation among a very small set of market participants, it does little to optimize the overall system. Indeed, because it precludes a wider market, it probably introduces a significant rigidity into the system.

A third example of an economic instrument is the performance bond. For example, the owner of a mine is often required to post a bond to ensure that environmental clean up is successfully completed when the ore body is mined out. The bond is often used in the case of mines because of the frequent experience of the company going out of business when the mine has no further value, leaving the government with the burden of cleaning up the site or the environment with the burden of a site that has not been remediated. The bond can have a great deal of flexibility because it can be spent later to deal with problems as they arise. Because the environmental legacy of mines – particularly large, open pit mines – may not be well understood when the mine is closed, this capacity can be very valuable.

2.2.2. Regulatory Instruments

An interesting example of a regulatory instrument that relates to our study is that of wildlife hunting quotas. These are policies that allow for quotas to be set, and hunting or fishing licenses to be issued so that the quotas will not be exceeded. The goal is to allow hunting or fishing, but not beyond some level based on population levels, etc. If the judgement used in setting the quota is correct, then the policy allows for sustainable hunting. However, as has happened in the East Coast fishery in Canada, if the judgement

is wrong, catastrophe can result. The policy has significant adaptive characteristics, in that it allows for review and learning on an annual basis.

2.2.3. Expenditure Instruments

One interesting category of expenditure instruments that exhibit adaptive characteristics is that of "automatic stabilizers". These are expenditure instruments that operate on the opposite cycle to the economy as a whole: when the economy is growing, automatic stabilizers spend less money, and when the economy is shrinking, they spend more. The net result is that the expenditures take place at a time when they will help the economy out of a downturn. One standard example is unemployment insurance, which pays out to people who become unemployed.

In a paper reviewing Canada's Unemployment Insurance (UI) system, Dungan and Murphy (1995) found that the UI policy instrument had a clear stabilizing effect on the Canadian economy. In the context of unemployment insurance, Dungan and Murphy describe the automatic stabilization function as:

> *It takes time before the problem of rising unemployment or a sluggish economy is recognized. Because there is a further lapse of time before policy decisions are made, implemented and have an effect on the economy, economists and policy-makers look for "automatic stabilizers" that respond immediately when the economy slips from the level of full employment. Such automatic stabilizers should respond quickly - changing taxes, or increasing or reducing government spending - to even out the economic impacts of cyclical fluctuations.*
>
> *There are two features of the UI system that should make it an automatic stabilizer. First, when unemployment increases, total UI payments increase, with only a short time lag. Secondly, when people lose their jobs, they and their employers immediately stop paying the UI premiums associated with those jobs. When an economic downturn results in fewer jobs, therefore, the total tax represented in UI premiums immediately falls. At the same time, increased payments in UI benefits puts some purchasing power back into the economy by automatically increasing government spending.*

2.2.4. Institutional Instruments

The Northwest Power Planning Council (NWPPC) is an example of an institutional policy instrument which has portrayed adaptive characteristics. The NWPPC was created via the Northwest Power Act in 1980. It is a federal agency with representation from Montana, Oregon, Idaho and the state of Washington (NWPPC 2002). The act directs the NWPPC to prepare a power plan and a fish and wildlife program that assures the region an "adequate, efficient, economical and reliable power supply" while at the same time can "protect, mitigate and enhance fish and wildlife (Digital Studios 1998)." The council was created to give the citizens of the region a say in "determining the future of key resources common to all four states (NWPPC 2002)." Lee (1993) describes that the

NWPPC was backed by a legal mandate to provide public information and involvement and sought to lower barriers to participation. The council was to judge its success partly on its credibility with the public. Lee states that the NWPPC adopted an "adaptive approach" to salmon enhancement, and among the individual components of this approach were the following:

- Adaptive management policy – testing and evaluation of projects wherever possible, taking into account the need for control or comparison cases for statistical validity;
- Research, monitoring and evaluation – continuing responsibility for monitoring linked to adaptive management;
- System integration and system planning policies – drawing together of policy initiatives so as to identify cumulative effects that would be missed within subunits.

Another example of an institutional instrument was Canada's *Green Plan* (Environment Canada 1992). This document states that the policy of the Canadian Government is to operate in a more environmentally friendly ways. It was published in the run-up to the Earth Summit, and is interesting in that it is an internal policy document, that bears the signature of every Cabinet Minister, but nevertheless had only limited impact.

2.3. Insights from Fields Relevant to the Study of Adaptive Policies

A certain degree of divergent thinking is helpful in developing an understanding of previously undefined concepts. In the sections below we highlight some useful insights from fields we felt to be closely related or relevant to defining adaptive policies. These sources include the literature on adaptive management, policy pilots, social, policy and institutional learning, and complex adaptive systems.

2.3.1. Insights from Adaptive Management Literature

Insights from the literature on adaptive management are relevant for adaptive policies for two related reasons. First, the two concepts are inherently similar in sharing the term "adaptive" and therefore insights will be important for defining what adaptive policies are. Second, the two concepts are different as "adaptive management" deals with management of a broader set of policies directed at an issue, while "adaptive policies" deal more with individual policies or instruments.

The notion of adaptive management, as it applies to the process of human intervention in ecological systems, is first attributed to the Canadian ecologist, C. S. Holling (1978). Adaptive management is most simply described as "learning by judicious doing"[S.1], and differs fundamentally from traditional anticipatory management by acknowledging that policy is necessarily experimental. Adaptive management is characterized by its flexible policies and the plurality of views that inform it; no particular epistemic community can possess all the necessary knowledge to form policy. Science, models, expert knowledge, and the policies based on them are not interpreted as ultimate answers, but merely as a

means to guide a cautious process of intervention in complex ecosystems. The goal of management shifts from achieving a single target to an integrated view of maintaining ecosystem resilience, avoiding for example catastrophic and irreversible "flips" to other equilibrium states (Holling 2001).

An early analysis of adaptive policy making in a natural resource management context is provided by Walters (1986). He discusses the problems that people and their institutions encounter in managing things like stocks of fish in the Great Lakes, and the damage caused by acid rain in Europe. Walters first discusses the fact that we do not understand the complex natural systems and thus are unable to make good predictions as to the results of various policy measures. However, people are very reluctant to adopt the type of policy response that will work well in such a situation, namely an adaptive response. It is very hard to get people to accept the idea of trying some responses to see how well they work, rather than relying on analysis and prediction:

> *It is quite natural for most people to think about other large investment programs in terms of a careful sequence of tests using such devices as market surveys and pilot studies. Somehow it is viewed as unscientific or threatening to talk about experimentation on large spatial scales, as though experiments were things to be done only in boxes or on benches in university laboratories. Worse, some scientists involved in our discussions were worried about the very notion of publicly admitting uncertainty, and felt that it was important to maintain at least the appearance of consensus within the scientific community. (Walters 1986, p. 343)*

Walters goes on to discuss some approaches that natural resource managers can use to try to get policy makers to change their attitudes. His suggestions regarding the types of attitudes to promote are listed in Table 1.

Table 1: Conventional versus adaptive attitudes about the objectives of formal policy analysis (Walters 1986, p. 351)

Conventional	**Adaptive**
Seek precise predictions	Uncover range of possibilities
Build prediction from detailed understanding	Predict from experience with aggregate responses
Promote scientific consensus	Embrace alternatives
Minimize conflict among actors	Highlight difficult trade-offs
Emphasise short term objectives	Promote long-term objectives
Presume certainty in seeking best action	Evaluate future feedback and learning
Define best actions from a set of obvious alternatives	Seek imagination in new options
Seek productive equilibrium	Expect and profit from change

Walters' advice on how to get people out of their normal analytical box is to highlight the difficult trade-offs, so that the managers are forced to confront the difficulties rather than defer tough decisions in the hope of improvements next year. Only when a stark reality is accepted, he feels, will creativity and openness to new solutions be available. And in complex resource management situations, creativity is necessary if good solutions are to be found.

Stienemann (2003) sees the current trend toward this concept of adaptive management as exploring three core principles, namely:

- ***"Experimentalism.*** Adaptive managers emphasize experimentalism within a dynamic system, recognizing that an ongoing search for knowledge is necessary to set and achieve goals.
- ***Multi-scalar Analysis.*** Adaptive managers model and monitor natural systems on multiple scales of space and time.
- ***Place sensitivity.*** Adaptive managers adopt local places, understand as humanly occupied geographic places, as the perspective from which multi-scalar management orientates."

It is also her hypothesis, based on decades of experience of systematic weaknesses in environmental impact assessment processes, that if the adaptive management processes being proposed today are to be successful, they will require new ways of involving the public in decision making.

The differences between adaptive management and adaptive policymaking can perhaps become blurred, particularly if one is dealing with an expenditure policy instrument in the form of a targeted government project or program. Busenburg (2001) helps somewhat to elucidate the difference between adaptive management and adaptive policy by noting that an "adaptive management strategy might include a number of parallel policy experiments designed to test different policy measures, as well as procedures for measuring and communicating the results." This was certainly the way adaptive management was viewed in Kai Lee's experience in the Columbia River Basin on the issue of salmon restoration and hydropower development.

Lee (1993) also introduces the notion of "civic science" in his discussions of adaptive management in the Columbia River Basin, which he describes as "being irreducibly public in the way responsibilities are exercised, intrinsically technical, and open to learning from errors and profiting from success." He goes on to note that "the challenge of building and maintaining civic science and the institutional relations necessary to do civic science is at the individual level. This is because civic science is a political activity; its spirit and value depend upon the players, who make up, modify, implement, and perhaps subvert the rules (Lee 1993)." Lee's insights into adaptive management, adaptive policy and particularly his ideas on civic science highlight the importance of the human dimension of adaptive policies and that learning from errors is a key aspect of the adaptive policymaking process.

2.3.2. Insights from Policy Pilot Studies

The field of pilot studies can provide helpful insights for adaptive policies because pilot studies are primarily mechanisms for learning and adaptation. A recent review conducted by the Cabinet Office in the United Kingdom (UK 2003) focused on the role of pilots in policy-making. The study noted that "an important innovation in recent years has been the phased introduction of major government policies or programmes, allowing them to be tested, evaluated and adjusted where necessary, before being rolled out nationally." (UK 2003, p. 3) The study noted that the practice of policy pilots has been relatively widespread in the United States owing in part to its federal structure, which allows state policy making to be regarded as large-scale experiments.

Among the recommendations made in the U. K. study, three in particular are relevant to adaptive policies and policymaking in the context of this project. The first is: "A pilot should be undertaken in the spirit of experimentation. If it is clear at the outset that a new policy and its delivery mechanisms are effectively already cast in stone, a pilot is redundant and ought not to be undertaken." The notion of experimentation relates to the notion of adaptive policy as articulated by Lee (1993) and acknowledges that uncertainty and surprise are inherent in the process. However, the policy pilot insights appear to imply that once the experiment has been run, a guiding principle will emerge to ensure its predictability. While this may be the case in many pure sciences, it is not the case in complex socio-ecologic systems which are adaptive. As Lee points out, it is ongoing policy development and experimentation that is truly adaptive.

A second recommendation from the study deals with extending the notion of piloting beyond just an initial stage to "a continuous processes of accumulating policy relevant evidence." A third recommendation of the policy pilots study is that "appropriate mechanisms should always be in place to adapt (or abandon) a policy or its delivery mechanism in light of a pilot's findings." Both of these recommendations speak directly to the primary thrust of the notion of adaptive policymaking presented previously by Walker et al. (2001), which was for learning and adaptation of the policy to be made *explicit at the outset* and the inevitable *policy changes to become part of a larger, recognized process and not forced to be made repeatedly on an ad hoc basis.* So while the policy pilots are an important initial stage in the life of a policy, the study concludes by making a call for the basic premise of testing, learning and adapting to become part of the ongoing policy life cycle.

The policy pilots study identified two types of pilots which provide useful examples for our project. These include:

- ***"Impact pilot*** – are tests of the likely effects of new policies, measuring or assessing their early outcomes. They enable evidence of the effects of a policy change to be tested against a genuine counterfactual, such as is provided by the use of control groups in a medical trial.

- ***Process pilots*** – on the other hand are designed to explore the practicalities of implementing a policy in a particular way or be a particular route, assessing what methods of delivery work best or are most cost-effective (UK 2003)."

These two types simply provide an important reminder of incorporating both outcome- and process-based measured in assessing the performance of policies.

2.3.3. Insights from the Policy Learning and Change Literature

A large literature on learning for policy change seems to conclude mostly that this is a complex and indeterminate process, conditioned by the nature of the structures and processes involved, and by the ways in which knowledge permeates these structures through interaction of individuals and groups. There is widespread agreement on the importance of networks, coalitions, or communities of interest, and the ways in which they interact, in the process of policy learning (Lindquist 2001, Sabatier 1999, Stone 2001). But the role of new knowledge in affecting policy is much less clear. The process has been studies in more detail in regard to new scientific knowledge. This is often debated and subject to criticism, from within the framework of its disciplinary and scientific origins, and also by non-scientific sceptics who are threatened by its implications. It takes some time, and occasionally a high-profile public crisis, before scientific evidence attains a degree of "consensus" in decision-making circles (Haas 1992).

Policy learning comes from a variety of sources: interestingly, academic research is a very limited source of policy learning. It is widely agreed that despite all the resources devoted to social science and policy research in the US during the 1960's and 70's, there is very little evidence that it contributed directly to measurable improvements in policy (Lindquist 2001). This ought to be particularly sobering for those who emphasize the role of scientific rationality and analysis in policy-making.

How is knowledge used to create policy learning? The policy learning and change literature suggests that new knowledge is always filtered by actors' values and belief systems, prior experience, association, relative power, professional training and norms. Policy change is normally driven by interactions among groups (or coalitions) of policy actors, where each group may include policy-makers, researchers, business or professional interests, and advocates. These advocacy coalitions compete with each other for power and political authority. Learning within these groups, like Haas's "adaptation", is normally a shallow process, limited to insights about choice of means and power strategies (Bennett and Howlett 1992). Fundamental challenges to assumptions or core beliefs of such groups are rare, partly because evidence is filtered by the group's own processes of information exchange and validation. And deeply-held values which motivate and give meaning to individual policy actors are highly resistant to learning (changes here are akin to religious conversion). However, political actors who are related to, but not captured by, the coalition group can sometimes learn from the discourse and debate between advocacy coalitions, and change their views on specific policy actions (Sabatier and Jenkins-Smith 1999).

cording to Haas, [S.2]a key role in policy learning is played by "epistemic communities": groups of professionals who share normative beliefs which provide a value basis for social action; commitment to a common causal model derived from study and analysis of a common set of problems or policy linkages; shared notions of validity in their domain of expertise and a common set of political values and commitments to translate their perceived truths into policy (Haas 1992). At times of crisis or rapid change, when information is at a premium, epistemic communities can become more important and influential in the policy process. They can shed light on causal relations which had previously been unsuspected, quantify uncertainties for decision-makers, help re-define the interests of the state or of various political interests within it, and directly contribute to policy formulation (e.g. through framing alternatives). But most of the time, epistemic communities and technical expertise will play only a limited role in policy formulation (Haas 1992).

Ultimately, the mechanisms by which even consensual knowledge and epistemic communities influence policy are quite murky. The same specialists may provide the same consensual knowledge to several governments, with quite diverse policy responses (e.g. similar evidence on environmental toxicity s nevertheless leads to different response[S.3]s). What is clear is that fundamental changes in underlying policy beliefs and assumptions, of the kind which would probably be needed in the event of policy failure or policy gaps due to external dynamics, are rare. Neither is knowledge neutral. There are few areas of policy importance which are not subject to scientific and technical debate, discourses between competing worldviews and "bilization of bias[S.4]" from available evidence (Stone 2001).

There remains concern in policy learning and change literature [S.5] ut the influence of technical specialists and their instrumentalist rationality on fundamental social and political decision-making. [S.6] Public debate and social discourse are important tools to balance the privileged access of technical expertise to power. Participatory processes also offer opportunities for policy learning, in ways which differ from policy models driven by expert, elite or advocacy networks. The outcome of deliberative practice (i.e. public decision-making which involves shared discourse, deliberation and social learning) is not abstract generalization, or discrete policy decisions, but shared meaning by the participants, and engaging narrative accounts of success or failure in their own terms (Forester 1999). Participatory processes are not merely about being heard, or about negotiation, or about sharing evidence and building consensus on facts (although all these are important), but crucially about political identity, about values, about building social cohesion and competence, mutual respect, hope and capacity to act. Such processes, though time-consuming, have crucial transformative potential in creating new, shared vision which can motivate learning and policy change.

Policy, whether "adaptive" or not, is almost always modified in its implementation (Majone and Wildavsky 1978). Policy ideals conceived as an analytical interpretation of complex problems, or as negotiated agreement between conflicting power groups, must inevitably take shape through the actions of implementing agents (typically lower-level

administrators). This process almost always allows discretion for substantial further political negotiation, interpretation, and modification as the policy is put into practice (Sabatier and Jenkins-smith 1999). How ought we to conceive of this implementation process in relation to policy adaptation? What aspects of policy implementation are of interest to adaptive policy-making?

At the limits, policy implementers can act to deliberately subvert the original intent of the policy. This kind of "adaptation" is not constructive: it denies the purpose of policy-making and the role of political accountability. Because policy differentially affects the interests of divergent groups, power also comes into play in steering implementation. However, there is an important role for implementing agents to play in smoothing the connection between the necessarily abstract and generalized views of higher-level policy decision-making, and the frequently complex contexts of specific application.

If policy implementation is challenged legally, questions of interpretation can be resolved by the courts (which often leads to policy revision or clarification). Most of the time, it will be public administrators and enforcement agents who are called on to interpret and enact policy. They use information, judgement, precedent and political power to introduce and sometimes negotiate modifications to policy which make it more easily implemented (Najam, 1995).

Adaptive policy embraces the constructive and judicious interventions of administrative practitioners who share the vision and goals of the policy itself An important implication of this is that effort needs to be devoted to building shared ownership of the policy vision and goals, best done through consultation prior to policy approval, through the institutional instruments discussed earlier.

Policies intended to enable local responses to national issues often do not recognize the diversity of contexts and conditions in which they will be applied. Through consultation, rapid iterations or "policy trials" the scope of these contexts can be explored, and policies revised accordingly. Adaptive policies will use such opportunities to increase flexibility and ease of implementation through modification. Adaptive policy-making will build in consultation and learning mechanisms, seeking practical examples and counter-examples of implementation issues in the field, and using evidence from case experiences to modify implementation frameworks. Monitoring and evaluation feedback are elements of such learning systems (see Tyler and Mallee on how participatory action research provides helpful insights for  process).

Ultimately, policy modification [S.7]and adaptation may fail, or new contexts may arise which are completely outside the effective domain of existing policy. Policy may need to be completely overhauled in the face of changing external conditions. An adaptive policy system will facilitate policy learning or change. This process is never going to be smooth and simple, and it will often be time-consuming. But to facilitate adaptive policies, we should want to ensure that policy learning and change eventually generates the desired outcome: effective adaptation to dynamic conditions.

Indeed, it is often not clear what are the outcomes of learning in public policy: adoption or non-adoption are only fragmentary measures of the diverse ways in which ideas, lessons from elsewhere and experience can contribute to changes in perceived roles, responsibilities and potential actions across a wide range of policy dimensions. And it is not clear how "learning" can be measured in policy processes, except by fundamental policy and value shifts, which often imply changes in the political parties or actors. Who is learning what when governments change?[S.8]

2.3.4. Insights from the Institutional Learning Literature

Berkes and Folke (2001) in their study of ecosystem dynamics and local knowledge define institutions as "humanly devised constraints that structure human interaction. They are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behaviour, conventions, and self-imposed codes of conduct), and their enforcement characteristics (North 1994)." Berkes and Folke also cite institutions as "the set of rules actually used by a set of individuals to organize repetitive activities that produce outcomes affecting those individuals and potentially affecting others (from Ostrom 1992)."

In citing this definition, Berkes and Folke (2001) highlight that "institutions are socially constructed; they have normative and cognitive, as well as regulative dimensions." (Scott 1995, Jentoft et al. 1998) It is the cognitive dimension that Berkes and Folke (2001) focus on in their study of ecosystem dynamics and local knowledge, because it is the cognitive dimension that deals with questions of "the nature of knowledge and the legitimacy of different kinds of knowledge."

Important to their work is the notion of institutional learning which they note takes place at the level of the institution as opposed to an individual level (drawing on the insights of Lee 1993). Institutional memory in relation to natural resources they describe as memory of experience "which provides context for modification of resource use rules, regimes, and typically refers to a decadal scale of time." It is noted that institutional memory incorporated local or traditional knowledge, and it is this "knowledge and an understanding of how to respond to environmental change" that are the "prerequisites for the management and sustainable use of resources, biological diversity, and ecosystems (Berkes and Folke 2001)."

They describe a conceptual framework for the analysis of linked social-ecological systems (Figure 2). On the one side is a nested set of ecosystems while on the other is a nested set of management practices which are embedded in a nested set of institutions. The linkage between the two is provided by ecological knowledge and understanding, without which the likelihood of sustainable natural resource use is "severely reduced."

Haas (1990) identifies "adaptation" in large international organizations as strategic behaviour which attempts to preserve the goals, identity and boundaries of the organization in response to stress, but to adjust its operational practices to ensure political survival. Adaptation is always incremental, and does not involve fundamentally new

knowledge or challenges to the organization's assumptions or ends. He distinguishes this from "learning" which is much less frequent, and involves the application of new consensual knowledge "to specify causal relations in new ways so the result affects public policy." Learning challenges individuals and organizations to question their fundamental beliefs about cause and effect, which underlie organizational assumptions and goals. Overcoming and changing behavioural patterns which led to past failure is central to Haas' conception of policy learning. In this paper, we use the word "adaptation" in different ways, but the concept of organizational learning for policy change which Haas articulates is close to what we intend by the term.

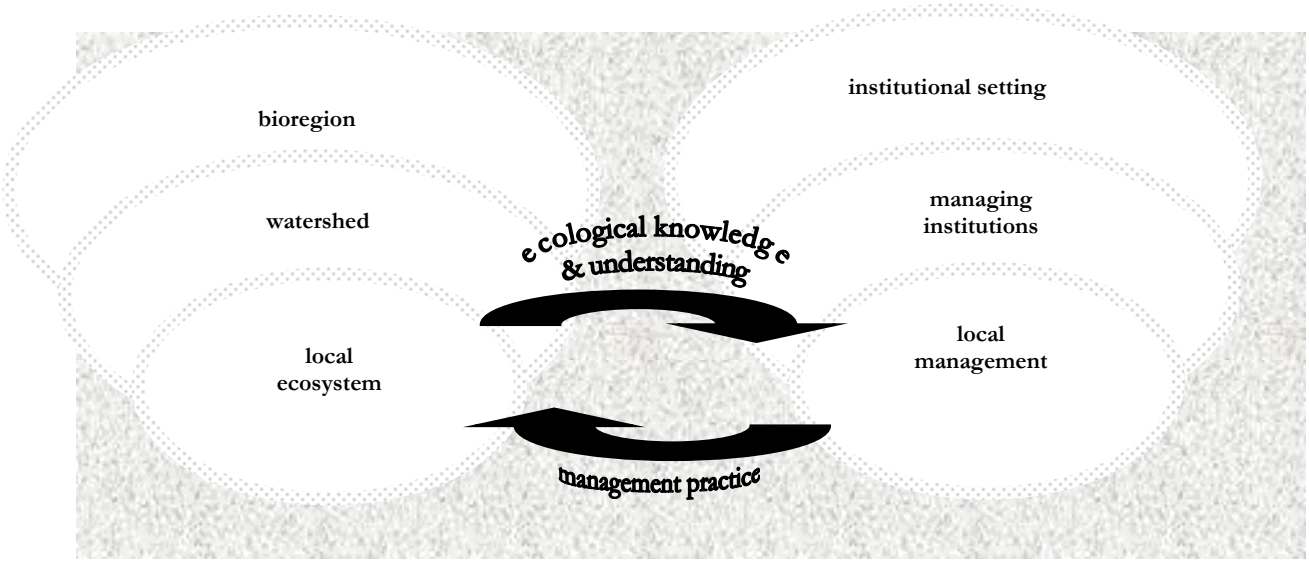

Figure 2 - Conceptual framework for the analysis of linked social-ecologic systems (Berkes and Folke 2001).

Organizational learning models developed for the private sector may not be very useful in the public sector, where bureaucratic structure and behaviour undermine many of the precepts of the models (Common 2004). In many government organizations the distance between decision-making and service delivery can be very large (both geographically and organizationally), complicating the ability of central authorities to benefit from the experience of field agents. A special problem in government organizations is the contradiction between learning and control: in conditions of flux and confusion, when learning ought to be prioritized, such organizations are more concerned with politics and [S.9]control. There are some examples in Canada and in the UK of governments setting up high-level groups to facilitate policy learning and external information flow. These groups were charged with looking outside the government itself to lessons from domestic think tanks, research organizations and other states, consistent with organizational learning prescriptions to strengthen "cross-boundary" information flows. While these have indeed increased access to information, it is difficult to find evidence of systematic

impacts on either policy formation or the operation of the bureaucracy (Lindquist 2001, Common 2004).

In their seminal book *Panarchy: Understanding transformations in human and natural systems*, Gunderson and Holling (2001) present a theory of adaptive change based on observations of ecosystems. Figure 3 presents this adaptive cycle within which four phases are typically seen:

- ***Exploitation*** – initially a few pioneers exploiting a resource
- ***Conservation*** – a mature and complex community
- ***Release*** – a sequence of rapid transformation triggered by disturbance (the beginning of a decrease in potential and adaptive capacity)
- ***Reorganization*** – a period of recovery leading to a decrease in potential and an increase in connectedness that allows for another cycle of exploitation.

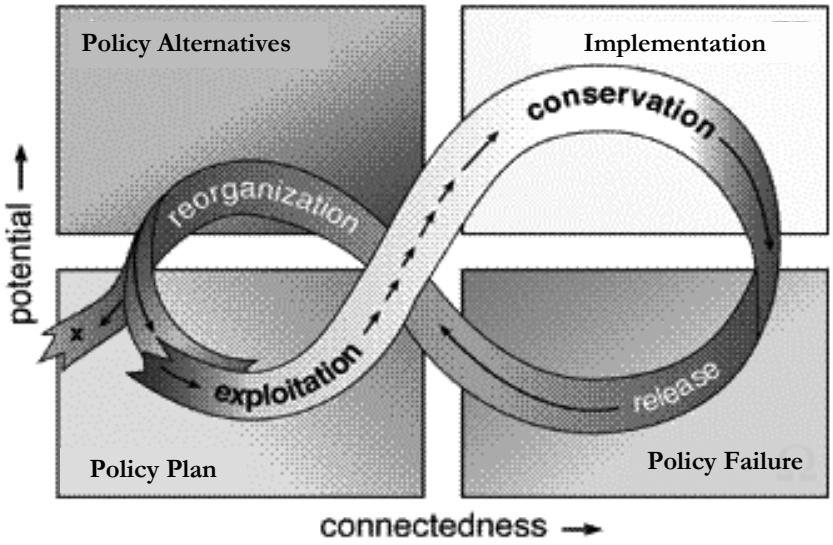

Figure 3 – The adaptive cycle (Gunderson and Holling 2001)

Gunderson et al. (2001) extend this four-phase cycle into the resource management policy realm for purposes of linking ecological and social dynamics, and this provides a useful perspective for adaptive policymaking. In their understanding the four phases of the adaptive cycle correspond to four phases of policymaking, namely:

- Exploitation -- Policy plan
- Conservation -- Policy implementation
- Release -- Policy failure
- Reorganization -- Policy alternatives

From an institutional perspective, Gunderson et al. (2001) note that the reorganization phase (e.g., policy alternatives) occurs when a "rare and unexpected intervention or event can shape new futures as an act of creating opportunity." In the conservation phase, tight

organization and hierarchical control which precludes alternatives is broken down due to the combination of maturing brittleness and external events. This "loss of control" releases capital such as money, skills and experience and dissociation into constitutive elements. The authors note that it is at this point that the system becomes ill-defined and loosely coupled providing the conditions for either collapse or innovation. It is this stage where, particularly in human systems, the potential to influence the future is considered greatest.

Janssen (2001) describes a conceptual understanding of institutions which assumes that agents change their preferred management style "if observations about the world are surprising enough – that is if observations differ enough from what the agents expect based on their worldview" (Thompson et al. 1990). They use the adaptive cycle and policymaking context presented previously in Figure 3 to articulate the changes and adaptations of institutions. The description is as follows:

> *The [exploitation] phase is defined as policy formulation. If that policy is successful it leads to increasing bureaucratic processes to formalize and institutionalize policies. The expectations of the institutions are mainly based on insights and information during the time policies were formulated. Since policy was considered to be successful, no new investigation is done on the quality of the expectations. Those groups with other perspectives on reality, leading to other expectations and preferred policies, will challenge ruling institutions. In the event of a surprise, the ruling institution is confronted with evidence that its expectations do not hold anymore, which can result in a crisis. Such surprises can be natural disasters, scientific or technological revolutions, and so on. After the start of such a crisis, a period will begin in which various alternative polices react to surprise. This can lead to continuation of the ruling type of institution with new policy initiatives, or a flip to a new type of institution (Janssen 2001, p. 250).*

Manley et al (2000) use the same framework, but develop a more applied cycle of four phases of adaptive management for natural resources (p. 692):

- Information needs identification
- Information acquisition and assessment
- Evaluation and decision making
- Management action

Their diagram of information and decision flow is much more applied compared to the conceptual approach found in Gunderson and Holling (2001).

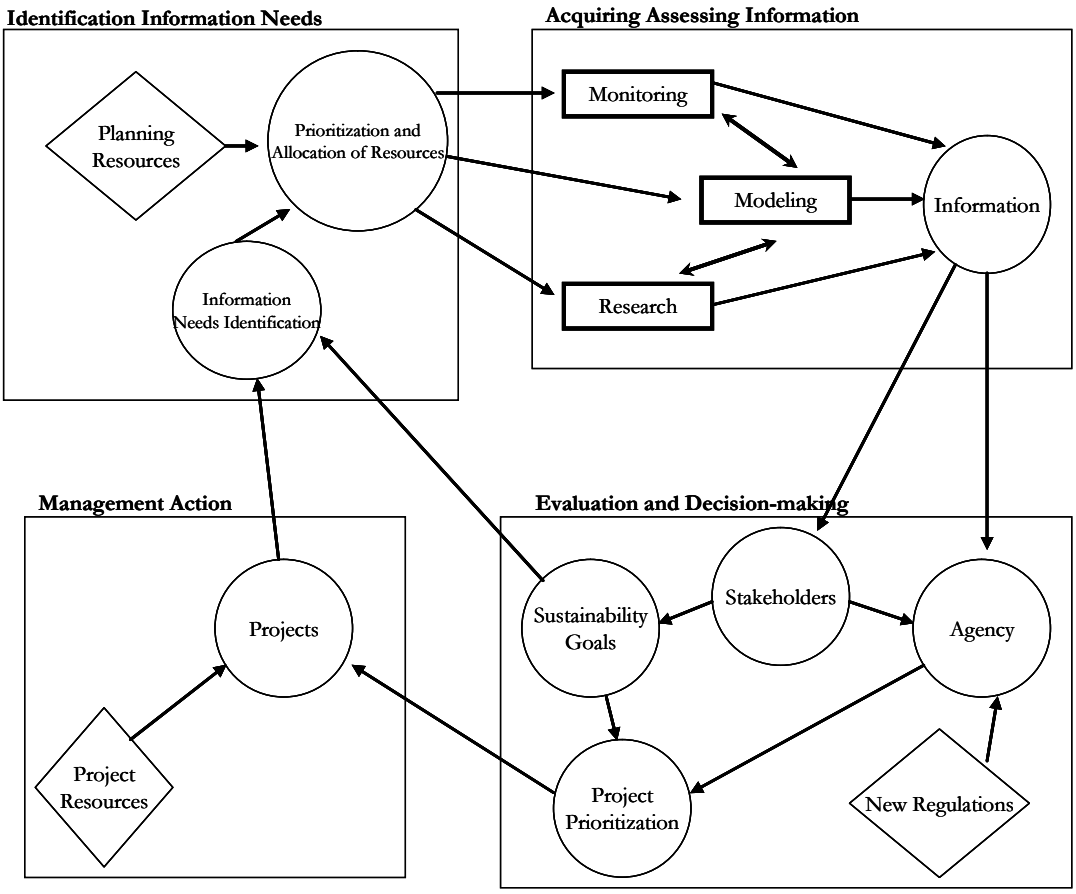

Figure 4. Four phases of adaptive management (Manley et al. 2000)

2.3.5. Insights from Natural Systems

Natural systems provide insights into what policy adaptation might be. Like policy systems, adaptive natural systems interact with their environments. They respond in non-linear ways to changing conditions. They are purposeful, in the sense that adaptation and transformation serve the perpetuation and function of the whole system, not of individual components.

However, the last few decades have seen advances in physics, mathematics and life sciences which have completely transformed scientists' understanding of how nature works. At its roots, the universe appears to be not composed of "objects" at all, but of events and relationships, ephemeral patterns of interaction which are impossible to predict or define except in probabilistic terms (Zukav 1979). Living organisms appear to interact with many elements of their environments, both material and non-material, in ways which may be frequently undetectable and unpredictable. Tiny, arbitrarily small changes seem capable, under certain conditions, of spawning large systemic consequences. There is growing recognition that when we try to ensure order, structure, stability and certainty in our organizations and systems through policy interventions, we

are trying to create unnatural conditions. We attempt to plan and control an objective reality which may be illusory, and we treat environmental systems and human organizations as responding predictably to change when science tells us non-linear systems may be well-ordered but are essentially unpredictable (much of the following section from the arguments of Wheatley 1999).

We have learned that highly adaptive natural systems have certain characteristics that reflect this emerging scientific view. They are driven and structured by flows of information and energy, so must remain open and responsive. Negative feedback uses information to provide control functions for system elements and maintains dynamic equilibrium conditions. But adaptive natural systems also swing into disequilibrium under unpredictable conditions, which then leads to rapid degradation of system elements and their re-ordering in a transformed structure to preserve the original function of the system. Particular attention is needed to what in systems terminology are called positive feedback loops, which signal imminent transformative pressures. Positive feedback is when a change in one direction causes the system to respond in ways which strengthen that change (e.g. melting of Arctic sea ice which reduces surface albedo causing further local temperature increases). Positive feedback signals that systems are about to move beyond incremental change to a chaotic transformation which results in fundamental re-structuring.

Policies also typically use control and regulatory mechanisms to maintain socio-economic systems through negative feedback. However, most information flows in large public or private organizations are designed to provide measures of how well programs are going and why things are working out as expected. Adaptive policies should recognize limits to control, and seek instead to foster attention to the unexpected, the counter-intuitive and the changes in elements which cannot be controlled. They should address qualitative change, and pay more attention to fundamental goals and values which are long-lived measures, in addition to quantitative indicators which may mask, rather than clarify, meaning. Policy design and targets should not focus solely on component elements, but keep attention on the broader whole, the big picture.

As science demonstrates that the foundational and persistent elements of our world are not objects or structures but forces and relationships, so adaptive policies need to address dynamic interactions between organizations, people and the world around them. Just as very complex natural structures can be seen to be built out of simple repeated patterns which interact at different scales, so adaptive policies might have simple and scalable principles, which respond to complex situations interactively rather than prescriptively.

Adaptive policies will enable and encourage positive action. Adaptive responses in large-scale socio-economic systems come from the creative action and engagement of people with their environment, not from their isolation and control. Policies which foster participation and encourage exchange of information will engage multiple actors in processes of change more quickly than otherwise.

Finally, natural science teaches us that healthy outcomes for adaptive systems come from simple, well-designed and iterative *processes*, not from strong structures. Adaptive policies should be process-oriented. Even highly chaotic natural behaviours demonstrate elegant order and pattern under the application of simple iterative processes.

2.3.6. Insights from Complex Adaptive Systems Theory

In the policy and management fields a substantive body of knowledge has emerged over the last ten years on the topic of complex adaptive systems. In all cases the study of complex adaptive systems was based on a need to better see the structures underlying complex situations and better identify leverage points for change. The recent study and application of complex adaptive systems can be seen in numerous fields including business management, healthcare, information technology, transportation, sustainable development and international development.

The characteristics of complex adaptive systems have been researched by many different groups. The adaptive cycle presented previously on Figure 3 is one example of such an articulation. Perhaps one of the more lucid descriptions was provided by Glouberman et al. (2003) in their study of improving health policy in cities:

> *…made up of many individual, **self-organizing elements** capable of responding to others and to their environment. The entire system can be seen as a **network of relationships and interactions**, in which the whole is very much more that the sum of the parts. **A change in any part of the system**, even in a single element, **produces reactions and changes in associated elements** and the environment. Therefore, the effects of any one intervention in the **system cannot be predicted with complete accuracy**, because the **system is always responding and adapting** to changes and the actions of individuals (Glouberman et al. 2003).*

In an internal workshop conducted at IISD in 2002 some of the key principles from this rapidly developing literature relevant to public policy were synthesized. For purposes of this project we have organized these principles within stages of an idealized continuous improvement management cycle for policymaking. These principles are presented in Table 2.

Table 2. Principles for Policymaking Informed by Complex Adaptive Systems Theory

Stages of a Continuous Improvement Management Cycle	***Principles for Policymaking in Complex and Adaptive Systems***
Understanding the issue	▪ Understand local conditions, strengths and assets (Glouberman et al.) ▪ Respect History (Glouberman et al. 2003) ▪ Understand interactions with the natural, built and social environment (Glouberman et al. 2003).
Policy objective setting	▪ Look for short-term finer-grained criteria of success that can usually stand in for longer-run broader goals (Axelrod and Cohen 2000)
Policy design and implementation	▪ Ensure that social capital remains intact (Ruitenbeek and Cartier 2001) ▪ Create opportunity for self-organisation and build networks of reciprocal interaction that foster trust and cooperation (Berkes et al. 2003; Glouberman et al.; Axelrod and Cohen 2000) ▪ Promote effective neighbourhoods (Axelrod and Cohen) ▪ Promote variation and redundancy (Berkes et al. 2003; Glouberman et al. 2003) - "Introducing small-scale interventions for the same problem offers greater hope of finding effective solutions." "It is critical to understand and accept that many interventions will fail. Such failures should not be viewed as failures of the overall way of understanding the system – this is simply a feature of how one develops successful interventions in complex adaptive systems (Glouberman et al. 2003" ▪ Balance exploitation of existing ideas and strategies and exploration of new ideas (Axelrod and Cohen 2000) ▪ Facilitate copying (Ruitenbeek and Cartier 2001; Axelrod and Cohen 2000). ▪ Use social criteria to support the growth and spread of valued criteria (Axelrod and Cohen) ▪ Combine experiential and experimental knowledge (Berkes et al. 2003) ▪ Nurture and enhance social and ecological memory (Berkes et al. 2003) ▪ Build adaptive capacity (Berkes et al. 2003).
Policy evaluation	▪ Conduct Selection (Glouberman et al. 2003) ▪ Assess strategies in light of how consequences spread (Axelrod and Cohen 2000)
Policy learning and adaptation	▪ Fine-tune the process (Glouberman et al. 2003) ▪ Understand carefully the attribution of credit (Axelrod and Cohen 2000)

These principles provide deep insight for both policy substance and process. The principles all listed under the design and implementation stage provide guidance for how policies can be made more effective by recognizing the key characteristics of complex adaptive systems (e.g., self-organizing potential, networks of interaction, etc.) and focusing on key leverage points for change founded in these characteristics. From a process perspective

3. A Working Understanding of Adaptive Policies

A number of key insights emerged from the review of literature on policy instrument typologies, adaptive policy and related literature. These key insights are discussed below as a framework for an initial understanding of adaptive policies for this project.

For purposes of this project it will be useful to establish some common terminology related to the different types of policy instruments. In a previous joint project between IISD and TERI policy instruments were broadly characterized in four categories as described in the literature review: economic, regulatory, expenditure and institutional instruments. There are other ways to categorize policy instruments, but this represents a reasonable starting point given that it already represents to a degree the shared understanding of IISD and TERI on this matter.

A brief review and analysis of a few policy instrument examples for each category, coupled with a review of the literature related to adaptive policymaking suggested that policies have two fundamental components:

- ***Instrument rules*** - define how the instrument is designed to perform;
- ***Instrument delivery*** – the actions of the people and organizations which implement the rules of the policy instrument

These two components are illustrated in the diagram below which present idealized processes for policy design and implementation. The instrument rules are created in a process with varying degrees of participation of relevant stakeholders and a delivery system is developed to implement the rules of the policy instrument. It is typically the case that an institution or organization different from the one which designed the policy, is actually responsible for implementing the instrument rules.

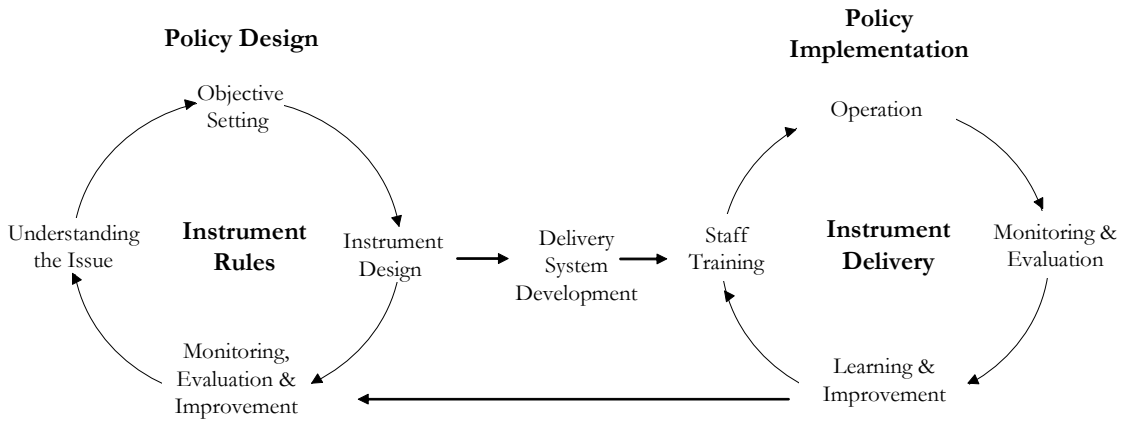

Figure 5 – Idealized illustration of policy design (rule component) and implementation (delivery component)

The instrument rules component is an inanimate or non-human dimension made up of the rules which define the action that the instrument is designed to perform, through legislation, regulation, or equivalent means. For example, penalties are defined for drivers who exceed the speed limit. However, the policy is implemented by people and organizations. So, the police officer that stops the speeding driver may just issue a warning. And the police department may decide that speeding is an issue that will be given low enforcement priority. This is the human dimension which we refer to as instrument delivery.

Our working hypothesis (which will be tested as we undertake the case studies) is that the ***flexibility*** inherent in policies consists of two components, which we call ***robustness*** and ***adaptability***. Robustness is the ability of the policy to react to a variety of anticipated circumstances. Thus the Income Tax Act example is one of a very robust policy, which has designed into it rules for many possible situations. We distinguish this from ***adaptability***, which is the ability of a policy instrument to respond well to unanticipated circumstances and longer-term change. For example, the creation of a market, such as the SO_2 market in the US, displays adaptive capacity in responding to technology and other unanticipated changes and still accomplishing its goal. These components of robustness and adaptive capacity can exist at many of the various stages of the policy design and implementation cycles shown in Figure 5 above.

From the literature there were only two sources which used the terminology of adaptive policy directly. These definitions provide insight toward both adaptability and robustness. For example:

Adaptability:

- "*respond to changes over time and make explicit provision for learning*" (Walker et al. 2001).
- Are created using an approach which makes "*adaptation explicit at the outset of policy formulation. Thus, the inevitable policy changes become part of a larger, recognized process and are not forced to be made repeatedly on an ad hoc basis*" *(Walker et al. 2001).*
- be "*designed from the outset to test clearly formulated hypotheses about the behaviour of an ecosystem being changed by human use"* Lee (1993).

Robustness:

- Be "*devised not to be optimal for a best estimate future, but robust across a range of futures*" *(Walker et al. 2001).*
- "*combine actions that are time urgent with those that make important commitments to shape the future and those that preserve needed flexibility for the future" (Walker et al. 2001).*

It would appear that adaptability could occur in either an automatic fashion or through informal and formal processes of monitoring, evaluation and improvement. For example, unemployment insurance in Canada functions as an automatic stabilizer. This is an example where the necessary learning and improvement in the policy instrument occurs

mostly in a mechanical fashion with little need for human interpretation, learning and action to occur for the instrument to adapt to new circumstances. At the other end of the spectrum adaptability requires human intervention to monitor changing circumstances, interpret and learn from the changes, and then make the necessary change to adapt the instrument to the new circumstances.

It is possible that a policy instrument can be robust, but not adaptive, or adaptive and not robust. We can illustrate the spectrum of robustness and adaptability in a two dimensional diagram that represents what could be called instrument flexibility space. Figure 4 presents such a flexibility-space diagram with adaptability plotted along on the horizontal axis and robustness along the vertical axis. As we conduct our case studies, we will attempt to place them on the diagram, to confirm its value as an analytical tool.

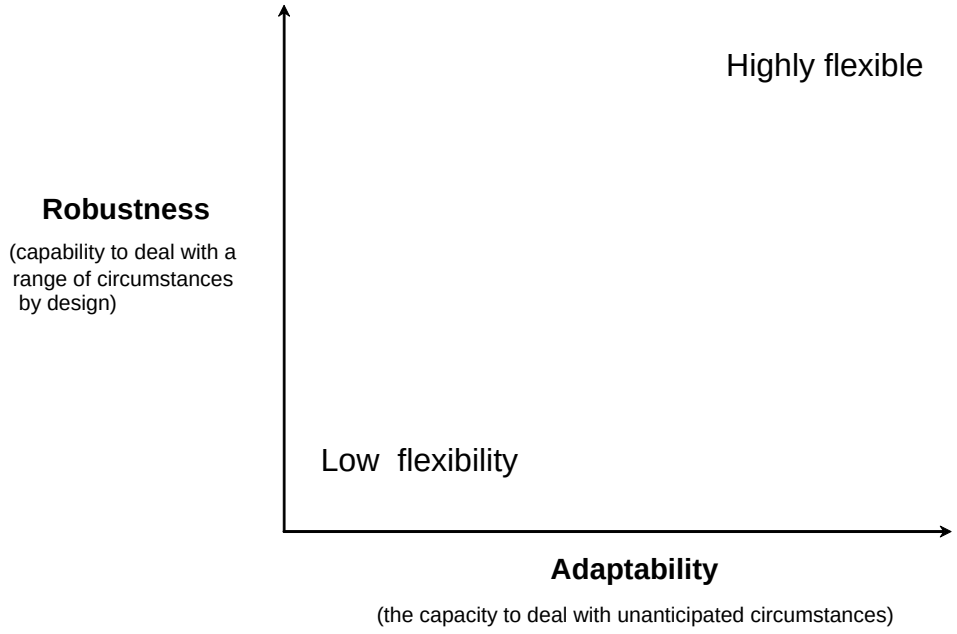

Figure 4. Policy Instrument Flexibility Space

3.1. Adaptability

The literature reviewed earlier suggests that there are at least two means by which a policy can be made adaptive. The first is the approach discussed by Walker et al.(2001), Lee (1993), and others, which is built on the ideas of policy experimentation and learning, and feedback into continually correcting systems. The second approach might be called the defining characteristics approach. Here, a list of design criteria are advanced, the presence of which will contribute to adaptability. A list of suggested characteristics has been drawn from the literature, as discussed in the *Policy Design and*

Implementation section of Table 2. Again, we will be using the case studies to validate and extend these two related but somewhat different mechanisms for adaptability.

3.1.1. Learning and Improvement Cycle

Mechanisms for policy learning may rely on information related to progress toward policy goals and objectives, and using that information to modify the policy. This is the cycle of evaluating, learning and improvement. From the definitions of Walker et al. (2001) it is clear that from a pragmatic perspective, aspects of indicators and assessment will play an important role in building adaptability into policy instruments. Of particular relevance are their ideas related to:

- *Signposts* – information that should be tracked in order to determine whether defensive or corrective actions or a policy reassessment is needed
- *Triggers* – critical values of the signpost variables that lead to implementation of defensive or corrective actions or to a policy reassessment

Intimately related to such indicators are specific actions which are undertaken based on an assessment of the information the put forth. For example, Walker et al. (2001) describe "*defensive actions"* which they note are taken after the fact to preserve a policy's benefits, "*corrective actions"* responding to triggers to adjust the basic policy, or "*reassessment"* of the instrument when the policy has lost validity. The literature on policy pilots informs us that aspects of measurement and assessment need to focus on both impact – to test the likely effects of policies, and process – to explore the practicalities of implementing a policy in a particular way (UK 2003).

As illustrated in Figure 5, the learning and improvement could occur in both the instrument rules component of policy design or in the delivery component of policy implementation. For example, the institution which designed the policy might have an internal process of checking whether the intended societal change is actually occurring. If this institution has the discretion to change instrument rules, such monitoring, evaluation and learning might directly result in an improvement in the instrument rules which would then need to be communicated to those responsible for implementing the policy.

Similarly, the people and organization(s) responsible for implementing the rules of a policy instrument might learn of a necessary change required to adequately implement the policy instrument rules. If they have the discretion to make this change, they can do so, otherwise they would communicate this learning to the policy designers in the hopes that this learning results in an improvement to the instrument delivery system. It may also be the case that the implementing institution, being close to the ground, learns that the desired societal change is not occurring, or that something negative and unexpected is occurring as a result of the instrument rules. If the implementing institution does not have the discretion to change the rules, this learning would need to be communicated to the policy designers in order for the necessary policy improvement to be assessed and carried out.

Additionally, the literature on complex adaptive systems was particularly insightful in understanding the rationale for adaptability through learning and improvement. For example, Glouberman et al. (2003) recognized that in complex adaptive systems policies "undergo selection by the system" and therefore, it is therefore important to include "evaluating performance of potential solutions, and selecting the best candidates for further support and development." Additionally, they also note the importance of fine-tuning policies because "in complex adaptive systems, which change over time and respond dynamically to outside forces, it is necessary to constantly refine interventions through a continual process of variation and selection." Another important insight from complex adaptive systems in relation to adaptability, and one that some researchers believe is particularly problematic for any adaptive approach is to "understand carefully the attribution of credit" (Ruitenbeek and Cartier 2001). This warning is all too familiar to anyone who has been engaged in performance reporting efforts. It recognizes that "even though individual agents try to judge successful strategies, the nature of complex systems is such that inferring cause is next to impossible" (Ruitenbeek and Cartier 2001).

The literature on adaptive management helps us to understand at least two things in relation to adaptive policies. First is that adaptive management is perhaps the descriptor of the overarching process of creating, testing and implementing multiple adaptive policies within a give place-based setting. Foe example, Steinemann (2003) views an adaptive management strategy as a number of parallel policy experiments designed to test different policy measures, as well as procedures for measuring and communicating the results." A second important insight is the recognition that multiple perspectives or a plurality of views is fundamental to an adaptive process – "no particular epistemic community can possess all the necessary knowledge to form policy."

Finally, the literature on policy, institutional and social learning suggests to us that policy learning is a slippery concept that does not provide much guidance on conditions which facilitate changes in fundamental paradigms or policy goals in response to dynamic external conditions. New consensual knowledge is promoted by epistemic communities and permeates policy networks. However, policy communities are internally defined by shared, deeply-held values and persistent interests. These characteristics contribute to their *resistance* to change and to selective adoption of new consensual knowledge which reinforces their shared values and assumptions.

However, the methodological challenges of disentangling learning and policy change measures in any practical way in research will continue to make it difficult to confirm the effectiveness of these factors empirically. The conditions under which fundamental (core) policy learning or paradigm shifts can take place are limited. Among the factors which should aid this shift are:

- Crisis or external pressure, along with public recognition of past failure
- Identification of feasible options which have a track record of success in other jurisdictions
- Loosely-structured networks of innovation and critical assessment of policy ideas, composed of diverse types of organizations

- Epistemic communities (groups of professionals and experts) who are convinced of the veracity of new knowledge and committed to its policy application
- Participatory deliberations on issues, both within government agencies and with the public, which can transform perceptions of fact, relations and roles to create new policy opportunities
- Deliberate efforts to collect information, including corroboration and contradiction, outside the policy organization's boundaries
- Contention, public discourse, and reflection which can reveal values, underlying assumptions and power relations implicit in policy dynamics
- Change of government!

3.1.2. Defining Characteristics of Adaptive Policies

Another means by which policies can become adaptive is through a number of defining characteristics which make a policy better suited to a world of surprise, change and uncertainty. Making a policy adaptive might also involve seeing more clearly at the outset of policy design *the structures underlying complex policy issues and the best leverage points for change* – providing an inherent ability to adapt to unanticipated circumstances. Table 3 lists characteristics or design criteria have been mentioned in the complex adaptive systems literature.

Table 3. Policy design and implementation insights from the complex adaptive systems literature

- **Ensure that social capital remains intact** (Ruitenbeek and Cartier).
  - If local groups and their networks are disempowered individually or collectively, existing social structures are in effect invalidated and undermined
  - Successes in the initial stages, no matter how minor, are critical for sustaining motivation
  - Participants must determine how they will share the benefits (and tasks) of the programme to sustain collective motivation and participation
- **Create opportunity for self-organisation and build networks of reciprocal interaction that foster trust and cooperation** (Folke et al.; Glouberman et al.; Axelrod and Cohen)
  - "Complex adaptive systems often spontaneously generate solutions to problems without external input or formally organized interventions…This self-organizing capacity is a free good that can be valuable in producing innovative and novel approaches to problems" (Glouberman et al.).
- **Promote effective neighbourhoods** (Axelrod and Cohen)
  - "Learning strategies in repeated simulations – reminiscent of adaptive cooperation – usually produced the most effective results in the long term" (Ruitenbeek and Cartier). If an effective neighbourhood can be defined it should be used as a learning structure within a broader system design framework (i.e., the neighbourhood and its parts become an agent, that may be replicated elsewhere).
- **Promote variation and redundancy** (Folke et al.; Glouberman et al.)
  - "introducing small-scale interventions for the same problem offers greater hope of finding effective solutions" and critical to the concept of development as learning is "that many interventions will fail" and "such failures should not be viewed as failures of the overall way of understanding the system – this is simply a feature

of how one develops successful interventions in complex adaptive systems."

- **Balance exploitation of existing ideas and strategies and exploration of new ideas** (Axelrod and Cohen)
  - Systems seem to shift between these two extremes, and both are ways of introducing variation within a system (Ruitenbeek and Cartier)
- **Facilitate copying** (Axelrod and Cohen).
  - Leadership plays a critical role since copying behaviour provides a powerful policy and design opportunity within any system (Ruitenbeek and Cartier)
- **Use social criteria to support the growth and spread of valued criteria** (Axelrod and Cohen)
  - "Pay attention to what criteria are valued locally. Money, for example, is not always that highly valued" (Ruitenbeek and Cartier).
- **Combine experiential and experimental knowledge** (Folke et al.)
- **Nurture and enhance social and ecological memory** (Folke et al.)
- **Build adaptive capacity** (Folke et al. 2002)
  - shift from policies that aspire to control change, to managing the capacity of social-ecological systems to cope with, adapt to, and shape change.

In the discussion of complex adaptive systems, one of the characteristics that is frequently mentioned is the capacity of systems to self organize. The corollary of this is that decision making must be decentralized to the level of self-organization, rather than concentrated centrally. It may be that one way to make an instrument more adaptive is to decentralize the decision making, allowing it (at least potentially) to respond to local circumstances. Many public policy instruments are, of course, designed in this way. As we proceed with the case studies, we will examine this possibility.

Walker et al. (2001) provide some additional insight toward mechanisms for policy adaptability. They introduce two types of actions they refer to as *mitigating actions* and *hedging actions* which are taken in advance to reduce risk of certain and possible adverse effects of a policy. One could imagine that in development of an income tax act where there was only one tax bracket, that the policy designers as a mitigating action to reduce the certain risk of a person's income being reduced too much in absolute terms, devised the system of tax brackets. Similarly, Walker et al. propose the idea of *separating actions now from those that can or should be deferred* until more information becomes available. This would appear to help build a sort of adaptive capacity into a policy instrument.

3.2. Robustness

Robustness, as the other important aspect of an adaptive policy (as we are seeing it at this point in the project), requires some further clarification. We suggested earlier that robustness is the ability of an instrument to deal with a range of ***anticipated*** circumstances. How might policy instrument rules be made robust to a range of anticipated circumstances? We saw from the policy instrument examples that in the case of the Income Tax Act of Canada, and for most income tax systems in fact, that tax brackets exist to allow the level of tax collected to be fairly distributed according the level of ones own income. This is a level of robustness that is built into the policy instrument directly. While our case studies will attempt to validate this division of

flexibility into the robustness and adaptability components, we will focus most of our attention on the adaptability component.

It would appear that one mechanism for making a policy robust is to do the most thorough job possible to understand the history and the issue. Insights from the complex adaptive systems literature provide some useful insight into this notion of robustness. For example, Glouberman et al.(2003) paid considerable attention to understanding the issue in recommending principles for health policy development in cities. They believed that understanding local conditions is vital to interacting in complex adaptive systems and that not doing so can make conditions worse due to the many inherent interdependencies. Perhaps most importantly, they recommend respecting historical conditions since complex adaptive systems are "shaped by their past and a knowledge of this history may suggest constraints on and opportunities on what can be done in the future."

4. Initial Conclusions: Understanding Adaptive Policies

Our working hypothesis (that will be tested as we undertake the case studies) is that the ***flexibility*** inherent in policy instruments consists of two components, which we call ***robustness*** and ***adaptability***.

Adaptability is the ability of a policy instrument to respond well to unanticipated circumstances and longer-term change. There appear to be at least two ways in which an instrument can be made adaptive: through formal and informal processes of continuous monitoring, evaluating, learning and improvement; and through specific defining characteristics which help make the policy more effective in a world of surprise, change and uncertainty.

Robustness is the ability to be effective under a range of anticipated conditions, and deals primarily with achieving as thorough an understanding of the policy issues as possible and building in to the policy the ability to deal a wide range of anticipated conditions.

For purposes of this project we define policy as a high level statement of objectives for a particular issue. Such policies employ specific policy instruments which can be placed into four broad categories, namely: economic, regulatory, expenditure, and institutional instruments.

All policy instruments can be considered to be made up of two components:

- ***Instrument rules*** - define how the instrument is designed to perform;
- ***Instrument delivery*** – the actions of the people and organizations which implement the rules of the policy instrument.

Both of these instrument components can have varying degrees of adaptability and robustness. Our project is designed to better understand how to increase the adaptability of instruments.

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