Adaptive policies, policy analysis, and policy-making

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Abstract

Public policies must be devised in spite of profound uncertainties about the future. When there are many plausible scenarios for the future, it may well be impossible to construct any single static policy that will perform well in all of them. It is likely, however, that the uncertainties that confront planners will be resolved over the course of time by new information. Thus, policies should be adaptive – devised not to be optimal for a best estimate future, but robust across a range of plausible futures. Such policies should 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. In this paper, we propose an approach to policy formulation and implementation that explicitly confronts the pragmatic reality that policies will be adjusted as the world changes and as new information becomes available. Our suggested “adaptive” approach allows policymakers to cope with the uncertainties that confront them by creating policies that respond to changes over time and that make explicit provision for learning. The approach 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. This adaptive approach implies fundamental changes in the three major elements of policy-making: the analytical approach, the types of policies considered, and the decision-making process. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

Policy-making is about the future. If we were able to predict the future accurately, preferred policies could be identified (at least in principle) by simply examining the future that would follow from the implementation of each possible policy and picking the one that produced the most favorable outcomes. For most systems of interest today, such prediction is not a possibility. When even the best model cannot predict the details of system behavior, the classical approach of choosing a policy based on the outcomes from a best estimate model is no longer credible. Such policies are best for a future that most certainly will not occur, and have implications for the future that actually occurs that are typically not examined in the course of policy design and analysis or even revisited as that future unfolds.
For very complex systems whose behavior we cannot predict, policies based on best estimate models can prove to be very fragile against unexpected events that happen all the time. Further, as policies must typically be implemented and modified over time, policies based on static analysis at one point in time are typically very unrealistic. They specify a policy from the perspective of an omniscient and omnipotent lawgiver, who dictates actions far into the future. This perspective flies in the face of the realities of policy implementation, which typically involves or should involve policy adjustment in the context of learning, debate, contention among a variety of stakeholders, and changes in the world and in society. Policy implementation must further recognize the presence of other actors who adjust their behavior in response to policies, each other's actions, and information they gain over the course of time. Thus, the appropriate metaphor for policy choice is one of equilibrium rather than optimization. Moreover, concerned parties inside and outside the policy “loop” will pursue their interests by political means as well. In this context, it is appropriate to separate the process by which policies are specified, assessed, chosen, and implemented from the policies themselves. In the approach taken here, it is the very flexibility or responsiveness of policies that preserves the policy-making structure.

Most policies must be devised in spite of profound uncertainties about the future. When there are many plausible scenarios for the future, it may well be impossible to construct any single static policy that will perform well in all of them. Fixed policies can fail for particular scenarios because they fail to exploit opportunities that arise, ignore crucial vulnerabilities, or depend for their performance on critical assumptions that fail to hold. Assumptions about the nature of the world can simply prove to be untrue, other actors may take actions in response to the policy that undermine its utility, or exogenous events may critically change the conditions under which the policy must operate.

For many problems, it is likely that the uncertainties that confront planners will be resolved over the course of time by new information. Data that clarify economic or industry trends may become available, new technologies may be developed, or political events may occur, all of which influence judgments as to which of various plausible classes of scenarios are actually occurring. Thus, policies should be adaptive – devised not to be optimal for a best estimate future, but robust across a range of plausible futures. Such policies will indicate near term actions that combine those that are time urgent, those that make important commitments to shape the future, and those that preserve needed flexibility for the future.

Policy analysis should take into account the fact that the effects of policy choices depend on information about events that have happened and events that are yet to happen, including choices made by others. Policy choices further depend on preferences over these effects. All of these change over time. So, the assessment process and the policies themselves should recognize the advantages of delay (for the sake of learning and flexibility), contingency planning, and pre-commitment.

In this paper, we propose a more realistic approach to policy formulation and implementation that explicitly confronts the pragmatic reality that policies will be adjusted as the world changes and as new information becomes available. Sometimes, these changes cannot be foreseen, but stem from random “shocks”. Other changes will be brought about simply by the advance of time, without any additional uncertainty. Finally, changes may occur as a consequence of policy implementation. Our suggested “adaptive” approach allows policymakers to cope with the uncertainties that confront them by creating policies that respond to changes over time and that make explicit provision for learning. The approach 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.

1 Indeed, a best policy chosen ex ante for an uncertain future may not be best ex post in any of the possible futures that might occur.
This adaptive approach implies fundamental changes in the three major elements of policy-making: the analytical approach, the types of policies considered, and the decision-making process.

2. Adaptive policy analysis

Traditional policy analysis compares static equilibria and assumes well-characterized systems capable of manipulation “from outside”. But for most real-world policy problems, disequilibrium dynamics are key, uncertainties about the future are real and fundamental, policy-makers have only limited sovereignty, and the best language to capture our understanding of process may not be the best language to debate judgments about outcomes. Current approaches to policy analysis have serious difficulties in dealing with problems characterized by complexity or disequilibrium behavior, systems undergoing significant organizational and structural change, and systems that can only be influenced rather than controlled. Such systems are fundamentally unpredictable. Context is key, in that policies that work in one instance may not work in another. Policies must often be incremental and adaptive, even as they address fundamental change.

The approach to policy analysis and choice that we describe in this paper is designed to capture the contingency and unpredictability, the interplay between destiny and accident, and the adaptability and memory that characterize today’s policy challenges. It is dynamic, thus allowing uncertainties to be resolved over time. It explicitly recognizes the value of additional information at different steps in the process, and the trade-offs in time and money to collect it. Further, it is designed to incorporate the actions and reactions of other players. In sum, it is a systematic method for developing and implementing a policy over time that is based on a clear set of constraints and objectives and that involves monitoring the environment, gathering information, and adjusting and re-adjusting to new circumstances.

3. Adaptive policies

Traditionally, public policy is embodied in a static set of rules and regulations enacted by a legislative body at one point in time. The policy remains in place until amended or replaced, often by different people, at some time in the future. In this paper we describe policies that comprise sequential combinations of policy options. Some options are to be implemented right away; others are designed to be implemented at an unspecified time in the future, or not at all if conditions are inappropriate. The policy includes contingency plans as well as a specification of conditions under which the entire policy should be reconsidered. The policies themselves are, therefore, designed to be incremental, adaptive, and conditional.

4. An adaptive policy-making process

The analysis and choice of an adaptive policy requires a new process for policy-making that explicitly takes into account the uncertainties and dynamics of the problem being addressed. It is this adaptive policy-making process, and the elements of this process, to which we now turn.

5. Designing an adaptive policy

We describe the adaptive policy-making process in terms of a “thinking phase” and an “implementation phase”. The thinking phase consists of a series of concrete steps through which we iterate until a policy has been defined and rules for its implementation developed. Although the process moves forward in clock time, we think in the op-

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2 The types and use of models to support this process may also need adjustment, but that is a subject for another paper.
3 In developing the adaptive policy-making framework, we have drawn heavily on the efforts of RAND colleagues, in particular Steve Bankes’ work on exploratory modeling (for example, Bankes, 1993), and Dewar et al.’s (1993) concept of Assumption Based Planning.
posite direction, reasoning by backwards induction from a particular (successful or unsuccessful) set of policy outcomes back through the actions and events that can lead there. The implementation phase consists of the actual sequence of events, inferences, and actions that represent the execution of an adaptive policy. In short, Section 6 describes a framework for formulating the policy problem, conducting the policy analysis and developing a policy, while Section 10 describes a policy and shows how it functions. Overall, we end up with an adaptive policy-making framework and a process for policy-making that deal with evolving uncertainty by taking advantage of information that may be available in the future. The policy involves taking only those actions that are necessary now and institutionalizing a process for learning and later action.

We illustrate some of the concepts using the development of a national civil aviation policy for the Netherlands as an example, but the concepts can be applied to any policy-making setting. In brief, the problem facing the Netherlands is that Schiphol Airport is running out of capacity and will not be able to accommodate growth in the near future. The forecast capacity shortage is largely a result of government constraints on aircraft movements, the number of passengers, the amount of cargo, and the amount of noise. The central policy questions are: Should demand be accommodated? If so, how? If not, how best to limit it?

6. Thinking phase

The first step in the adaptive policy-making process is a “stage-setting” exercise designed to make policy objectives explicit, develop a clear set of options, and construct a definition of policy success that makes operational sense. Successive steps in the process

- assemble the structure of the policy,
- identify key uncertainties,
- separate actions to be taken now from those that can or should be deferred until more information becomes available,
- develop signposts for monitoring changes in the world and triggers for contingency plans, and
- establish limits to the validity of the analysis that, once violated, should lead to a reassessment of the policy.

Before we “walk through” Fig. 1, it is useful to define the essential elements of the adaptive policy that emerge from the process. These “building blocks” include:

- **basic policy** – an infrastructure option and one or more additional policy actions, together with a plan for their implementation;
- **vulnerabilities** – potential adverse consequences of the policy associated with key uncertainties regarding the assumptions of the basic policy or “side effects” of that 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;
- **additional actions to be taken in anticipation of or in response to specific contingencies or expected effects of the basic policy; these can be further divided into:**
  - **mitigating actions** – actions taken in advance to reduce the certain adverse effects of a policy;
  - **hedge actions** – actions taken in advance to spread or reduce the risk of possible adverse effects of a policy;
  - **defensive actions** – actions taken after the fact to clarify the policy, preserve its benefits, or meet outside challenges;
  - **corrective actions** – adjustments to the basic policy in response to specific triggers;
  - **reassessment** – a process to be initiated or re-started when the analysis and assumptions critical to the policy’s success have clearly lost validity.

Although the timing of actions will be considered in the implementation phase, there is a
definite relationship between the thinking phase and the implementation phase. In the following sections, we describe the major steps in the adaptive policy-making process.

7. Step 1: Setting the stage

The activities in the rounded box in the upper-left corner of Fig. 1 constitute the stage-setting step in the policy-making process. In this step, the important objectives, constraints, and available policy options are specified or discussed. Out of this discussion comes a definition of success, which is a specification of the outcomes in terms of the stated objectives and constraints that the participants in the policy-making process would find acceptable.

For illustrative purposes, we may take a simplified picture of the current situation in the Netherlands for our stage setting. The objective could be to maintain a major role for the Netherlands in civil aviation. The constraints could be those imposed by noise, emissions, economic, and other considerations. And the policy options could include various ways of increasing airport capacity and a host of measures for shaping demand, increasing efficiency, and mitigating adverse side-effects of a growth in air transport.

8. Step 2: Assembling the basic policy

The next step is assembly of the basic policy. This involves two related activities: (1) specification of a promising policy, and (2) identification of the conditions that must be met in order for it to succeed. These conditions complement the definition of success by providing an advance warning of failure.

Continuing the example, a basic policy could be developed around the expansion of Schiphol Airport, the current national airport of the Netherlands. It might include the building of a new runway, plus additional measures for reducing noise around the airport, such as accelerated
phasing out of noisy aircraft and changing takeoff procedures. Necessary conditions for success of this policy might be that the demand for air transport continues to increase and that Schiphol maintains its market share compared to competing airports.

It should be noted that success and failure must be defined in terms of sets of possible outcomes, any one of which can be classified as acceptable or unacceptable. Since the results of a policy choice cannot be known with certainty when the choice is made, definitions of success and failure, like estimates of policy effects, are necessarily somewhat indeterminate; the result of a policy will be a lottery over policy outcomes. An analysis of alternative adaptive policies would need to be designed to shed as much light on the character of this lottery as possible, to give sufficient scope for risk aversion, strategic choice, risk-spreading activity, etc. The important activities of defining success and failure must take account of this variation by determining when the possible outcomes of a policy overlap sufficiently with the “acceptable outcomes” zone (see Fig. 2).

### 9. Step 3: Specifying the rest of the policy

In the third step of the adaptive policy-making process, the necessary conditions for success and the details of the basic policy are combined in two sorts of forward-looking analyses, which result in a specification of the remaining pieces of the policy. One analysis is the identification of vulnerabilities – potential adverse consequences of the basic policy. These vulnerabilities can reduce acceptance of the policy to the point where its success is jeopardized. Vulnerabilities of the basic policy in the Schiphol example might be that: (1) some national governments continue to subsidize their (inefficient) national carriers, giving those carriers an unfair competitive advantage; (2) other European airports increase their capacity; (3) airlines replace their hub-and-spoke systems (which help make Schiphol a major airport) by a different system; and (4) KLM Airlines is acquired by another airline or goes bankrupt, leaving Schiphol without a hub airline.

Associated with certain vulnerabilities, such as increasing noise around Schiphol from a growth in air transport, are mitigating actions to be put in place immediately. These might include buying out homes in the noise zone, subsidizing sound insulation or real estate markets, paying compensation, or creating “noise markets”. In anticipation of uncertain vulnerabilities, such as an increased risk of accidents, various hedging actions can be developed to diversify or reduce exposure or

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5 Interpreted broadly here to include fear of ruin, preference for flexibility, minimum regret, and other methods for making choices under conditions of uncertainty and risk.
cushion the consequences. In our example these might include subsidizing business or residential insurance.

The second analysis is the translation of the necessary conditions for success into signposts that should be monitored in order to be certain that the underlying analysis remains valid, that implementation is proceeding on schedule and according to expectations, and that necessary policy corrections or additional actions are taken in a timely and effective manner. The identification of signposts does not call for immediate implementation of any direct policy actions. But once signposts are identified, efforts must be initiated to collect and monitor the necessary information. The critical levels and appropriate contingency plans that make up the triggers should also be specified in this step. Signposts in the Schiphol example might include monitoring the growth of demand for air transport and monitoring the health of KLM (e.g., market share, profitability, and/or return on investment). Slower than expected growth in demand might trigger a delay in the expansion of Schiphol. If KLM shows signs of failing, actions might be taken to prop it up, reduce competition from other airlines, or attract another hub airline to Schiphol.

10. Implementation phase

Once the above policy is agreed upon, we are in the implementation phase. In this phase, events unfold, signpost information is collected, policy actions may be altered, started, or phased out, etc. The adaptive policy-making process (as distinct from the adaptive policy itself) is suspended until a trigger event is reached.

The response to a trigger event depends on the nature of the alarm. Many contingencies will have been foreseen in the original plan, or can be handled within the discretion of those charged with implementing the plan. They will decide whether to defend a policy that is in jeopardy or to pursue the objectives of the policy by other means. As long as the basic policy, objectives, and constraints remain in place, these responses can be characterized as defensive actions or corrective actions. In our example, a major air disaster may overwhelm the hedging and mitigating provisions, and lead to widespread dissatisfaction. Depending on the nature of the public debate, these concerns could be addressed by:

- defending the policy in public forums, conducting accident inquiries, highlighting the economic effects of expansion, sharing information about impending safety improvements, etc.;
- defending the basic policy by instituting additional safeguards;
- defending policy objectives (a major Dutch role in civil aviation) by expanding the feeder-reliever role of regional airports to reduce dangerous congestion at peak times; or
- correcting the policy by, for example, scaling back expansion plans, adding supplementary demand-shaping policies, undertaking additional investment in air traffic control, intervening in flight scheduling, etc.

If the trigger is slower than expected demand growth, some combination of reduction in the planned expansion or direct demand subsidies may be employed.

Under some circumstances, neither defensive nor corrective actions will suffice. For instance, there may be major changes in stakeholders' objectives, extremely large shocks to signpost information (e.g., a collapse of demand, runaway growth in demand, rapid growth in regional air traffic), or significant unforeseen actions by other players (e.g., a large cooperative expansion of Charles de Gaulle and Berlin airports or an EU directive imposing an open market in landing slots). In such cases, the policy should be re-examined in its entirety. This means restarting the policy process.

But the process would not have to be started “from scratch”. In the first place, when the policy is reassessed, much more will be known about the world and the identities, motivations, and capabilities of other key players. In the second place, many aspects of the policy will already be in place and, to some extent, irreversible. Additionally, more will be known about the effects of the initial policies. Finally, participants in the process will have a significant collective commitment to the process as a whole.
The conditions triggering a reassessment should be stated explicitly as part of the original policy (just as the conditions for corrective and defensive actions are part of the policy).

The main difference between the concept of time in the thinking and implementation phases is that the thinking phase divides time into two periods: now and later. It defines a set of policy actions, and distinguishes actions to be taken (or initiated) now from actions to be taken after certain information becomes known. Whether that means one year or 10 years is not specified; the time scale for the resolution of uncertainty or implementation of the policy (other than the simple ordering of contingency plans) is not necessarily specified. Moreover, time in the thinking phase runs backwards: from desired end results to combinations of circumstances and actions that may lead to them, and the means used to secure good outcomes and avoid or mitigate bad ones.

Thus, adaptive policy analysis looks both from the present to the future and from the future to the present, in order to develop ways of comparing where we are going to where we would like to go. It views uncertainty as something to be qualitatively understood in order to manage the timing of critical decisions and to develop robust policies – policies that will work well in a range of plausible futures. And it explicitly makes use of new information to resolve the original uncertainties over time.

References

