Adaptive Regulatory Systems

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We examine adaptive behavior in forming and changing utility regulatory systems. Systems with independent regulatory agencies dampen the effects of political and market power, and diminish information asymmetries, which improves sector performance. But creating or adapting the system triggers resistance from those who experience loss and at weakens regulatory effectiveness for some period of time. Using empirical studies from behavioral economics and psychology, we construct a model that examines where such losses occur and identify techniques for encouraging adaptive behavior.

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Situations arise where economic systems are called upon to adapt to changes in technology, the economics of technology, or beliefs. As Schumpeter [CITE] is noted for pointing out, these adaptations represent disruptions and fortunes are made or lost based in part on how people participate in the change. North [CITE] explains that institutions and their adaptive capacity influence the nature of change. Change is at best slow in institutions where norms are costly to change. Indeed in some situations is it more costly to reform an institution than to dissolve and replace it.

Regulated industries and their associated regulatory systems are examples of situations where change can be difficult because some firms may have market power and control essential facilities, regulated firms often have special rights and responsibilities (such as exclusive franchises and obligations to serve), and laws, government institutions and others entities must adapt for the change to occur. The revolution in US telecommunications since the 1970s is a case in point: The change involved service provider divestitures, mergers, and bankruptcies, as well as regulatory agency changed roles and priorities, and lost authority. Opening electricity supply to competition in the late 20th century led to divestitures, new entrants, and changes in regulatory jurisdiction. Outside the US, private participation in formerly state-provided utility services involved changes for labor unions, a shift in investment and hiring control from political bodies to private operators, and the formation of regulatory agencies whose relationships to government[1] implied a fundamental change in the features of political power for many countries.

The difficulty of change in regulatory systems has manifested itself in several forms. In some situations customers struggled to adapt: In the case of Bolivian water reforms, some communities went into an uproar over privatization of their water utilities. Privatization of electric service in

[1] We use the term "government" to mean the public sector – including executive, legislative, and judicial activities, that has authority over laws, associated decision marking and public resources, but not publicly-owned enterprises.

the Republic of Georgia also led to public protests, motivated in part by the belief that the service should be a government benefit. Indeed some customers suffered electrocution attempting to steal electricity. Government bureaucracies and politicians struggle with loss of power and control: In the Republic of Georgia, government would interfere with the private operator's electricity dispatch to direct power to politically powerful communities. The Office of Utilities Regulation in Jamaica sued the Government of Jamaica to keep it from clawing back authority over utility prices. And courts and regulators often miscalculate the direction and effects of change: The US breakup of AT&T was designed based on a belief that local and long distance telephone service were distinct markets. This assumption was proven false when unregulated cellular services adopted nationwide calling plans. The US Federal Communications Commission (FCC) in the 1980s and 1990s attempted structural separation, video dial tone, and other regulations to direct the development of advanced services. The Internet trumped all of these efforts. US utility regulators formed electricity market operators, called Independent Service Operators, to enable greater competition in anticipation of customer benefits, but their presence failed to lead to lower prices for consumers. [CITES]

These difficulties raise the question of whether adaptability in regulatory systems could be improved. The question is timely because of changes currently occurring in the electricity industry: Some US state regulatory commissions, such as in New York and Minnesota, are investigating whether to impose new utility business models. [CITE] The UK has adopted a new utility-regulator collaborative model for utility planning and pricing. [CITE] Many governments and regulators are directing utility technology choices. California, for example, is directing investment in electricity storage. [CITE] In addition fragile states seeking to recover from conflicts often introduce new governance models for infrastructure services. All types of

countries experience adaptive challenges when considering reforms of water governance in an attempt to improve the quality and efficiency of water delivery, and the management of wastewater.

This paper addresses the issue of adaptability of regulatory systems by examining the features that makes a regulatory system effective, identifying which features are challenged by adaptive issues, and reviewing recent findings in neuroscience, behavioral economics, and psychology to describe how adaptivity can be effected in a regulatory system without sacrificing the system's essential DNA, i.e., those aspects that, if sacrificed, would make the system ineffective. The DNA metaphor seems appropriate: The genetic differences between humans and chimpanzees is small, approximately 2% of their respective DNAs are different. But that small genetic difference results in a meaningful phenotype difference. And attempts to alter the other 98% might destroy rather than enhance. So our purpose is to identify that metaphorical 98% and describe how the other 2% can adapt as context changes. We limit our analysis to utility regulatory systems.

The remainder of this paper is organized as follows. The next section identifies the features of utility regulation. Section II develops the notions of adaptation and adaptive capacity. It explains the underlying science of loss and adaptation, and considers situations where countries are adapting regulatory systems. The last section is the conclusion.

I. The DNA of Utility Regulatory Systems

The DNA of a regulatory system includes those features that have proven effective for achieving the system's purpose. Some of the features primarily involve the regulatory agency, but many implicate the overall system, i.e., the other organizations such as courts and political bodies that function to effect regulation and the relationships between institutions. The purposes

of regulation include controlling market power [CITE], controlling political power [CITE], and providing rents to important stakeholders [CITE]. The latter is not a noble purpose of regulation, but appears to be present nonetheless. In addition to achieving its purposes, a regulatory system must be sustainable lest it simply falter.

We begin with a description of modern utility regulatory systems and then identify what appear to be the critical features.

A. Modern Utility Regulatory Systems

A public utility is a natural monopoly whose performance has such a significant impact on customers and the country in general that effective regulation can provide substantial public benefit, namely in the improved functioning of the economy. [CITE] The lack of competition often results in inefficiency, limited investment, and high and exploitive prices, regardless of whether the utility is privately owned or state owned, the effects of which are significant because of the sector's importance.

As the public utility concept emerged in the 19th century, governments responded to the monopoly problem either by public ownership or by regulation. Regulation was initially performed largely by courts through their management of lawsuits, or by political bodies, such as city councils and state legislatures. Regulation by lawsuit suffered from being ad hoc, allowing providers an information advantage over courts and plaintiffs, and largely benefitting those with better legal representation. Regulation by political bodies suffered from corruption, instability, and expropriation, as well as the information advantage that utilities held over politicians.[2] These early systems were quite adaptable, but were missing features for effectively controlling market and political power.

[2] See generally, Glaeser (1927) and Henisz and Zelner (2001).

Governments began experimenting with specialized regulatory bodies in the 1800s, but it wasn't until the formation of independent regulatory agencies with price authority in the early 1900s in the US that governments found a system that had the qualities of controlling both market power and political power, and that could be sustained over time. As we explain in more detail below, the essential features include: (1) Alignment of purpose and design; (2) Clarity of roles; and (3) Sustainable relationships. In a sense, it is all about alignment. And it is all about roles. And it is all about relationships. We discuss each of these in turn.

B. Alignment of Purpose and Design

The utility regulatory system incorporates design features that enable it to control market power, control political power, and essentially ensure commercial viability of utility services. The critical features for controlling market power include clearly delineated markets, agency authority, and agency independence.

Market definition matters because it defines the scope of economic regulation, i.e., where market power begins and ends, and the industry boundary that offers customers the optimal bundle of commodity characteristics. We have already described cases, such as the breakup of AT&T and broadband development, where regulation struggled to achieve its purposes because regulators misidentified markets. There could be parallels in today's electricity system where regulators continue to struggle with market design for kilowatt hours and for generation capacity in order to accomplish the service that customers actually receive, i.e., a grid connection with stable voltage and amperage in the presence of volatile customer demand.

Controlling market power implies the authority to restrict prices, subject to limitations in law regarding confiscation of property and undue discrimination. We describe these restrictions more

fully in the subsection on commercial viability. Explicit in pricing authority is political independence of the regulatory agency.

Independence means that the regulatory institution operates at arm's length from stakeholders, including politics, i.e., it treats each with equal deference in decision making. Independence from the service providers is essential for controlling market power because, were it not for independence, regulation would be more likely to protect market power than control it. Independence from stakeholders (not the government) is important to limit rent seeking, which if left unchecked, would threaten the economic role of the public utility. We explain next how independence relates to government.[3]

Regulation by independent agencies serves to control political power, primarily by limiting political opportunism, but also by restricting rent seeking through the political process as described in the previous paragraph. Opportunism is commonly referred to as the hold-up problem. With respect to privately owned utilities, hold-up results from the absence of credible commitments by the government not to expropriate assets or the returns they generate.[4] A government's inability to commit to allowing a utility to recover its costs increases risks associated with investments, and in particular investments that: (1) Are largely sunk, i.e., that cannot be reversed without significant loss of value; (2) Have economies of scale and scope,[5] which decreases the number of operators the political actors have to monitor; and (3) Have large political interest, i.e., political actors can attract positive public attention by damaging the service provider. (Spiller 2005) Unless properly addressed through strong property rights laws and

[3] As we explain in the subsection on clarity of roles, independence does not mean that the regulator has no overseer; rather it means that the regulatory institution operates in a very specific accountability system that motivates the agency to serve the broader, long-term political priorities of the country rather than the more narrow or short-term priorities of well-positioned politicians.

[4] Henisz and Zelner (2001).

[5] Economies of scope are cost savings that occur because of producing multiple products. It is an element of cost subadditivity.

independent regulatory agencies, the risks of the hold-up problem cause utilities to under invest. (Heinisz and Zelner 2001) The hold-up problem also exists for state-owned utilities, although there is evidence that the effects are less pronounced than for privately owned firms, at least in the electricity sector. (Cubbin and Stern 2006)

The mechanisms that facilitate political independence include regulating under the law, transparency, and an independent judiciary for reviewing appeals of regulatory decisions. Regulating under the law generally means that the agency's purpose, design, governance, and authority are set out in statutes, although in some jurisdictions the agency is constitutional.

Transparency is the feature of regulation that allows others to observe how the regulatory agency conducts its business. In effect, it allows persons to look over the shoulder of the regulator. Transparency mechanisms include due process (providing potentially affected stakeholders an effective opportunity to be heard), making decisions based on public record, and published decisions that explain the origin of the regulatory issue addressed, the agency's legal authority to address the issue, the parties involved and the information provided, the decision, and the connection between the information and the decision. Transparency often restricts private discussions between decision makers, and between individual decision makers and stakeholders. Transparency promotes political independence by limiting the channels through which politicians can influence regulators without public knowledge, and by building support for the regulatory system.

To ensure that the regulatory agency operates under the law, the system includes checks and balances, such as the opportunity to appeal regulatory decisions. Countries tend to use one of three basic systems – appeals to government ministries, appeals to special tribunals, and appeals to judiciary – the appeals to an independent judiciary being the approach that provides the

greatest political independence. [CITE] Countries vary in whether appeals can be based on legal grounds, such as the agency's authority to make a decision or the process used, or on substantive grounds, namely that the agency made an error in logic or fact. To our knowledge, no studies have examined whether this scope of appeal affects independence.

Laws concerning the authority over prices should include requirements that revenues are adequate to attract investment. This implicates the price level and political risk. Experience provides that pricing rules should prohibit the regulator from denying service providers an opportunity to recover costs that were prudently incurred to provide regulated services. There remains, however, the risk of political action that would make the utility service lose its commercial viability.

In addition to diminishing utility operators' information advantage over the government, a primary purpose of an independent regulatory agency is to serve as a stabilizing force for the utility investment environment, at least with respect to political machinations. This latter, stabilizing influence is important because of the inherent differences between the political world and the utility investment world. The political world has a short planning horizon – rarely longer than the time to the next election – and it derives its authority from the citizenry. The investment world has a long planning horizon – 10 to 40 years, depending on the type of investment – and depends largely upon capital markets for its resources. Because these two worlds are different in their priorities and needs, direct engagement of the two, for example, utility regulation directly by political bodies, generally results in inadequate investment relative to what might be considered a social optimum. An independent regulatory agency can serve as a buffer and stabilizing force between the two worlds. It serves as a buffer by absorbing the political pressures that would hinder effective utility investment and by comprehending to the extent practical the

context, abilities, and effort of utilities. It serves as a stabilizing force by holding to planning horizons that extend beyond election cycles and bridging across the peaks and valleys political priorities, and by adhering to processes that value precedence and consistency.

C. Clarity in Roles

Although there is general agreement regarding the value of independent regulatory agencies, institutional forms vary across countries: Some counties like the U.S. have commissions, other countries like Jamaica have a single director, and still other countries like the U.K. use a board-CEO structure. Although there are variations in agency structure, there is a typical overall governance structure for regulation, within which there are three line roles, namely those of policy maker, regulator, and operator.[6] (Jamison and Castaneda 2014) Some countries combine two or all these primary roles into a single organization, which leads to inefficiencies. (Eberhard 2014) This diminished effectiveness occurs because of the information, expertise and opportunism issues described earlier, but also because institutions take on particular natures as a result of the work they do and the relationships they maintain. These acquired and innate characteristics cause institutions to have different capabilities.

Figure 1 illustrates this governance model:[7] Authority runs vertically beginning with the country's citizens. Policy makers act as representatives of citizens, much as a board of directors of a private company serves as representatives of shareholders.[8] Policymakers identify policy priorities and, primarily thought laws, communicate these priorities to head(s) of the regulatory agency, who the policymakers also hire. These priorities should be expressed in laws so that they

[6] Eberhard (2014) includes owner as a separate function. We combine owner and operator into a single role for purposes of this paper.

[7] Jamison and Castaneda (2014) illustrate a modification of this model to reflect financial governance for a state-owned utility.

[8] Policy makers may be a legislative body, a ministry, or some other body that is in touch with citizen needs, is answerable to the citizens, and has sufficient strategic and executive skills to establish policy, respect roles, substantively reflect on outcomes, and evaluate and reform strategies.

are transparent and stable. The agency leadership is responsible for developing the agency and its staff, establishing regulatory rules and procedures, and making decisions on prices, service quality, and the like in an effort to achieve the policy priorities. The utility's responsibility is to make efficient management decisions within the boundaries and frameworks set by the regulator. Accountability runs the opposite direction of authority and the primary channels for communication run vertically throughout the model. (Jamison and Castaneda 2014)

[Place Figure 1 about here]

Table 1 illustrates the basis for this governance structure. It maps institutions to roles based on their inherent capabilities and weaknesses. This table illustrates the shortcomings of each institution that limit its effectiveness to serve other roles (such as the policy body playing the regulator role) and that also provide hurdles to success even within its role. For example, the Government Policy Body's authority to act opportunistically together with its incentive to serve its own political needs can make it a very poor regulator because operators, realizing this body can be better off confiscating value rather than allowing the operator to profit from its investments, will keep their financial exposure low by reducing investment. (Levy and Spiller 1996; Spiller and Savedoff 1999). Each institution has an incentive to take on at least certain aspects of the other two roles, creating authority conflicts especially when the system is being established or transformed.

[Place Table 1 about here]

An important feature of the model illustrated in Figure 1 is placing authority in institutions that have the proper information, expertise, and accountability. For example, making decisions as to how energy is provided is in the hands of the utility in this model. If the regulator or policy maker concluded that the status quo might not be providing the energy security or environmental

protection that is needed, they might be tempted to impose solutions. In some countries, for example, Prime Ministers or line ministers have unilaterally negotiated power purchase agreements presumably in the belief that the country could benefit from the additional generating capacity or the technology choice. However, because of its information advantage and expertise, the utility is in a superior position relative to policy makers and regulators to evaluate the technology, capacity needs, and costs.[9] Furthermore, the utility may also be the organization that bears the financial risk of the decision[10] because a common practice is for the contract to have specified that the utility will pay for the power. In other instances customers are held accountable in the sense that they ultimately pay for the power through their bills, through lower service quality, or both. Economic decisions are more likely to be sound when they are made by those who have the best information and expertise and who have the economic incentives to make the efficient decision.[11] For the regulator or the policy maker to substitute its judgment for the utility's operating expertise is to take away the utility's authority to manage itself without taking away the utility's accountability for outcomes.

D. Sustainable Relationships

If the writers of the US Declaration of Independence were correct that a government derives its legitimacy from the consent of the governed, it seems fair to say that independent regulation derives its legitimacy and sustainability from the consent of the governed and the governing. In

[9] Ensuring that the utility uses this information for the good of customers generally requires development of incentives that align the utility management interests with the customers' interests.

[10] Private owners bear financial risk unless that risk is transferred to someone else, such as customers or taxpayers. In the case of state-owned enterprises, taxpayers are the owners and effectively underwrite the financial risk. Management and employees also bear financial risk if poor performance limits their incomes, scope of work, or future prospects.

[11] Hayek (1944). Also, as Milton Friedman observed in a 2004 interview, there are four ways to spend money. The approach that incentivizes the most careful consideration is when the person making the decision has earned the money and is the beneficiary of how it is spent. Ross, Ron, "A Further Perspective: Friedman's Four Ways: Who's spending whose money? That's the critical question," The American Spectator (October 5, 2011) http://spectator.org/articles/36815/friedmans-four-ways. (Accessed October 29, 2014.).

other words, the effectiveness of the system relies in part on the willingness of the players – the political bodies, the regulator, the courts, the operators, the customers, etc. – to willfully submit themselves to the roles of the others. The alternative to such willful submission is a hierarchical political authority structure that will not control political power, and is unlikely to control market power.

The role structure described in the previous subsection highlights largely formal restrictions and requirements on roles and relationships. But these formal restrictions leave unanswered questions such as: (1) What prevents a country's president or prime minister from simply stating that he or she is firing people from the regulatory agency even if the political leader lacks authority to do so? This has happened in numerous countries and generally the regulators leave office rather than engage in a legal battle. (2) What prevents a regulator from ignoring an adverse court decision and proceeding as if it had won the case? This has occurred in other sectors, but we are unaware of this happening in utilities. And (3) what prevents a utility from effectively ignoring regulator decisions about prices, service obligations, and the like? In some countries service providers have challenged the regulator's will to enforce its decision by ignoring demands and fines.

Figure 2 illustrates that the regulatory system includes numerous relationships – some formal and some informal. The actors are shown by the boxes filled in black and the transactions between them are shown with arrows. Breakdowns in these relationships weaken the system even if the formal rules remain unchanged. For example, some regulators have gotten into public fights with operators. This consistently diminished the trust the public, politicians, and others had in the regulator, and sometimes in the operator, making it difficult for the regulator to address

complex issues. In some instances, courts recused regulators from decisions involving the affected utilities.

The essential nature of these relationships is mutual consent based upon communication, confidence in technical abilities, and knowledge of values and activities. Each example cited above where relationships have broken down incorporated the absence of one or more of these relationship features. However, there is nothing unique to utility regulation in this regard. Literature on management and leadership contains numerous references to the need for communication, technical competence, trust in values, and mutual knowledge of the work being done.

II. Adapting Regulatory Systems

Thus far this paper has focused on the technical issues that motivate and affect the design of regulatory systems. As anyone who has been involved in creating or changing an organization knows, getting the technical aspects of organization right does not guarantee success. Indeed the change itself brings about many challenges. This section discusses these challenges in a regulatory context and examines how they could be addressed.

There are three basic changes that can occur regarding regulatory systems. The first is the formation of the system itself, where ministries, operators and others give up activities and roles that they used to perform to the newly created regulatory agency. The traditional participants also change how they operate, giving up what they have done to be successful in the old system and creating new habits and practices. The second basic change is system adjustment, which may be minor or large. Relatively minor adjustments would include moving some licensing responsibilities from the ministry to the regulatory agency. Major adjustments would include merging of sector regulatory agencies into a multisector agency, and forming a supranational

regulator, such as ECTEL. The third type of change is reform within an agency by reorganization, for example.

The remainder of this section is organized as follows. The next two subsections lay the groundwork in psychology, neuroscience, and behavioral economics for studying regulatory system change. The first subsection explains resistance to change by examining adaptive challenges and loss. The following subsection explains the capacity of systems for change by describing adaptive capacity. The final section applies these concepts to two change scenarios.

A. Adaptive Challenges and Loss

Change is often met with resistance, not because people inherently resist change – many people change jobs or get married with great eagerness – but because they resist loss. (Heifetz and Linsky 2002) The losses that people experience in regulatory change can be quite varied. For some it might be a loss of prominence, such as a regulatory agency giving up its pricing role when deregulation occurs. It might also be a loss of control, such as a politician giving up the ability to direct the utility where and when to make investments when a regulatory systems such as that shown in Figure 1 is put in place. In some instances the loss might simply be that a person or group knew how to operate in the old environment and, even if they agree that a change is needed, they still experience a loss of certainty or of comfort because the new approach has unanswered questions.

These losses represent adaptive challenges that can lead to failure or dysfunction if not adequately addressed. (Heifetz and Linsky 2002, Jamison 2007) Adaptive challenges are those that question established values, customs or habits, attitudes, and behaviors that people hold dear. [CITE NORTH] This is in contrast to technical challenges, which in this context are those that involve writing laws, conducting economic and financial analyses, designing organizational

structures, and the like. (Heifetz and Linsky 2002) Addressing adaptive challenges involves a different set of skills than does attending to technical challenges because adaptive work addresses feelings of loss that are experienced when, for example, individuals must rethink basic goals, lose authority or identity, or give up traditions and time-honored strategies. According to Laurie (2000), successfully performing this adaptive work includes helping people identify the deeply held beliefs that are in conflict with the new direction, discovering what has to be learned and what new habits have to be formed, and determining what competing values are at stake. Leadership in such situations questions the status quo and exposes people to the reality of the new situations.[12] Table 2 summarizes the differences between technical and adaptive challenges.

[Place Table 2 about here]

B. Adaptive Capacity

The ability of an individual, organization, or economy to recognize and adapt to changed circumstances is called adaptive capacity. To be adaptive, an individual devotes resources to observing and engaging with novel experiences and adjusting beliefs according to those experiences. Heifetz (1994) calls this adaptive learning or adaptive work. The subjective cognitive effort and emotions involved in this work compete with other activities, such as doing one's day-to-day work, for time and energy. An individual with higher adaptive capacity relative to others is sacrificing productivity in the current situation in anticipation of being more productive than non-adaptive individuals should circumstances change. However, the sacrifice of current success diminishes the individual's current influence and future opportunities.

Similarly, institutions are adaptive if their employees are open to novel experiences, devote resources to exploring their meaning, and adopt new norms when appropriate by aligning individual beliefs and institutional practices with the novel experiences. Consistent with the

[12] See generally Heifetz (1994), Heifetz and Linsky (2002), Laurie (2000), and Pascale et al (2000).

consequences of maintaining adaptive capacity in individuals, maintaining the capacity of the organization for novel experiences means that the organization is incurring costs that could be put to use providing current products and services with great expertise, making the organization less technically efficient[13] than it would be otherwise. For a regulatory agency this diminished efficiency, as well as the devoting of resources to activities that would appear tangential to core responsibilities, could result in negative reviews and media coverage, which could result in diminished resources for the agency. Devoting resources to interpreting novel experiences lowers technical efficiency, but the adaptive learning is necessary for creating future alignment of individual and institutional norms, which is in turn needed for future technical efficiency. The paradox of adaptive learning for the organization is that devoting resources to adaptive capacity may be important for the survival and effectiveness of the institution during times of change, but the sacrifice of technical efficiency may put the organization in peril. [CITES]

Mental energy is used for cognitive functions and for affect, or emotions, and incorporates the what-should-be norms that a person adopts. (North 2005) Affect has the ability to command all available energy, such as when a person loses emotional control, including freezing with fear. Affect is essential for decision making. Cognitive processes can identify the what-is of a situation -- for example that the object barreling towards a pedestrian is a car and that the pedestrian could be killed -- but it is the affect that provides valuation, such as concluding that injury to the pedestrian would be bad and is worth physical effort to avoid. The portion of the brain that is used for affect is physically closer to the sensory portions of the brain than are the analytical portions and so affect receives information and begins its response before the individual is cognitively aware of the information. The brain manages the amount of energy

[13] X-efficiency refers to the degree of efficiency, measured in terms of cost minimizing behavior, maintained by individuals and firms under conditions of imperfect competition. Individuals and firms maximize efficiency to be successful. The term first was used by Leibenstein (1966).

consumed by affect based upon automatic processes that are beyond conscious decision making in the initial moment.[14] However these processes are shaped by experiences and by the subjective effort that the person exerts to modify the processes. Changing these processes, as well as changing automatic cognitive processes, takes energy, time and repetition. [CITES]

A person with adaptive capacity is devoting resources to awareness of novel information, consideration of novel experiences, and updating valuations. These are both cognitive and affective efforts, and they consume scarce energy and attention that could be devoted to current activities. Another consequence of personal adaptive work is a sense of loss that the person might incur in giving up things that have been valued in the past. For example a person may resist acknowledging evidence that regulatory independence improves sector efficiency if the person values traditions of politicians assisting constituents with infrastructure issues. Of course there are people who embrace constant change. Such individuals draw excitement and identity from ideation, but face their own adaptive challenges when situations call for effecting new norms, which requires repetition, rather than for creating. Either type of person – the person who values the past and the person who values change – experiences loss when changed circumstances imply that he or she should set aside the preferred practice. [CITES]

For an organization to have and use adaptive capacity, at least some individuals must engage in adaptive work. In addition the norms in the organization must change in adaptive work. Costs of adaptive capacity for the institution include personal costs and the resources the institution must commit to establishing and maintaining the appropriate norms. Furthermore the adaptation of institutional norms creates the potential for additional personal losses when, for example, the institutional change involves changed relationships and changed prominence of particular roles.

[14] Camerer, Loewenstein, and Prelec (2005) explain that there are also affective controlled processes. We simplify our discussion by embedding these in processes where controlled cognition challenges the affect.

C. Regulatory Adaptation

The challenges of regulatory change include addressing the technical and the adaptive issues. The technical challenges of setting up energy markets, identifying market power, establishing structural and behavioral remedies to market power, establishing rules for price controls in the presence of weak or emerging competition are well known. What is lesser known is how to address the adaptive challenges of learning and loss. In this subsection we examine two change scenarios: Establishing a regulatory agency and adapting to changes in technology.

Tables 3 and 4 illustrate ways that forming agency or adapting an agency-based system can create adaptive challenges. We describe these in more detail below and possible processes for addressing the learning and loss challenges. In general the processes should include the elements described earlier in this section, namely exposure to novel experiences over time, acceptance of technical efficiency because of ambiguity and adaptive learning, and acknowledgement of loss and learning new roles.

Table 3 illustrates the adaptive challenges for forming a regulatory system around an independent regulatory agency. The checkmarks in the columns marked "Before Agency" represent whether the policymaking body or the operator had primary responsibility for the roles in the "Illustrative Responsibilities" column. These responsibilities indications are illustrative; i.e., they are not intended to be comprehensive, nor would they reflect the situations for all countries. The checkmarks in the columns marked "After Agency Implemented" represent whether the policymaking body, the newly instituted regulator, or the operator has the primary role once the regulatory system includes an independent regulatory agency. Each loss of a checkmark in the change from before to after represents an adaptive challenge for the institution that loses a role, and may represent an adaptive challenge for those who depended on that

institution for that role, or who had a relationship in that role. Each added checkmark in the change from before to after represents a learning challenge for the new role and an adaptive challenge for those who have to form new relationships for this role to be effective.

In practice the creation of a regulatory agency raises challenges in almost all of the institutions and relationships shown in Figure 2, but Table 3 focuses on the line roles. In the political arena, for example, successful politicians know how to continue to win elections, which may include their abilities to change utility services in ways that benefit constituents and supporters. For example, a politician may create visibility and provide a sense that he or she is important for protecting constituents by being proactive or vocal on issues of utility prices, foreign influence on utility matters, or the environment. He or she may also create a sense of common identity with constituents by protecting jurisdiction. For example locating regulatory decision making at a local level, such as in a state in the United States or an island nation in the case where island nations are considering sharing regulatory authority, may provide constituents with a sense that the politician understands their perceived uniqueness and is ensuring that their special context is not lost in a larger, more general regulatory institution. The loss of roles for politicians and operators represent adaptive challenges that will require learning and may trigger resistance. The newly formed regulatory agency will need to establish its role in the hearts and minds of the institutions and persons in Figure 2. This will involve proactively explaining the reformulated regulatory features, explaining the new roles, and establishing sustainable relationships. In many situations policy bodies have formed new regulatory agencies and then changed nothing in their own activities as if nothing happened. This is a normal human response to adaptive challenges, namely that change implicates others, not ourselves.

Table 4 illustrates the situation of adapting a regulatory system in the presence of industry reform, such as might be triggered by a technology change. A significant difference between this scenario and the Table 3 scenario is that Table 4 reflects a situation where the ultimate industry structure and industry, regulator, and policymaker roles are uncertain. The marks "H" for high, "M" for moderate, and "L" for low indicate the degree of involvement of the line institutions in each illustrative responsibility in the first column. The "Before Reform" columns represent the situation before the system begins to adapt and the columns in the "Learning Phase" columns represent the situation for the institutions to engage in adaptive learning, i.e., learning what from the old system should be discarded and what should be kept, and experimenting with new roles and relationships. A final system representing a proper alignment, proper roles and sustainable relationships should emerge from the learning phase, but we do not illustrate what that might be.

Table 4 illustrates that each institution's role expands during the learning phase, but with some decrease in specificity. For example the policy body becomes engaged in the public dialogue, reviews of industry performance, and reviews of system design in the learning phase, but decreases its control over market structure. The new responsibilities are important for learning and expanding relationships and the decreased control is needed for experimentation. These role changes present adaptive challenges for the policymakers as they have to resist rent seeking in market structure and engaged in discussions with regulators, the public, and industry that are have a more peer-to-peer nature than was the case prior to the learning phase.

The regulator actually decreases its number of responsibilities and its control over many of its other responsibilities. These changes are needed to allow experimentation, but they present adaptive challenges for the regulator because it deliberately lets go of its ability to solve problems. This letting go will feel unnatural to the regulator, not just because of the loss of role,

but also because of the tendency of humans to be over confident. Studies in psychology and economics have revealed a tendency in each of us to believe that we have more information than we actually do and more ability to objectively analyze information than we actually possess. The regulator will be tempted to draw premature conclusions about technologies and their impacts, adopting practices and rules that appear appropriate to the regulator, but that will ultimately result in a less effectively industry.

The operator's role expands considerably as it becomes an active player testing alternative technologies, business models and the like. Adaptive challenges for the operator will include openly sharing experiences with regulators and policymakers, accepting that visible mistakes will be made, and bearing greater commercial risk for the business practices it is testing.

III. Conclusion

Formation and reform of regulatory systems require complex technical work and adaptive work. Most of the research over the years has focused on the technical aspects, in effect assuming that the adaptive work takes care of itself. This assumption is problematic. Technical work and adaptive work require different leadership approaches and different leadership skills. Indeed the differences are so significant that some authors object to using the term "leadership" to describe the guidance of technical work.[15] The adaptive challenges involve the loss that at least some stakeholders experience when thinking about changing a regulatory system, leading these stakeholders to resist the change. The leadership challenge is to find ways to help these stakeholders manage their losses and find compensating value in the future.

[15] See generally Heifetz and Linsky (2002).

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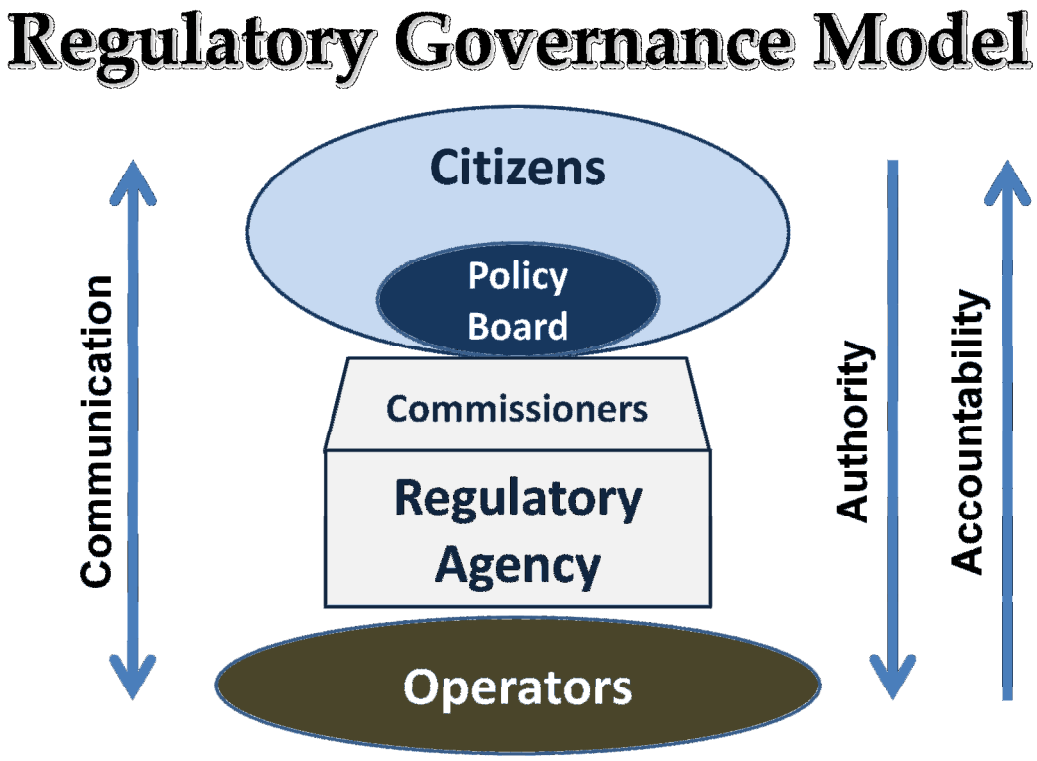
Figures and Tables

Figure 1. Utility Governance Model



Jamison and Castaneda (2014) and Brown (2006).

Table 1. Typical Governance Model for Electricity Policy, Regulation, and Provision

Institution	Capabilities	Weaknesses	Role
Government Policy Body	• Proximity to public perspectives and pressures • Generalist regarding public policy priorities • Incentivized to respond to public opinion and public information	• Lacks sector and technical expertise • Authority to act opportunistically • Incentive to focus on own political needs • May be protective of its role	Strategic Direction: Like a board of directors, identifies priorities, develops strategies, reflects on outcomes, and oversees regulatory body
Regulatory Body	• Proximity to customers and operators • Sector and technical expertise • Distance from political pressures	• Limited sector operational and financial expertise (relative to operator) • Lacks close proximity to public • Specialist regarding government policy • Incentive to expand and protect role, and to serve the desires of the agency	Implementation of Laws: Developer and enforcer of rules relating to operator conduct
Operator	• Expertise in operations • Knowledge of costs, technologies, and capabilities • Financing • Customer relations	• Focuses on how to deliver rather than on what should be delivered and why • Has private information that it may use to its advantage • Incentive to serve the desires of the managers • May be protective of its role	Provision of electricity within the boundaries of regulatory rules and within physical and financial realities

Figure 2. Utility Regulatory System

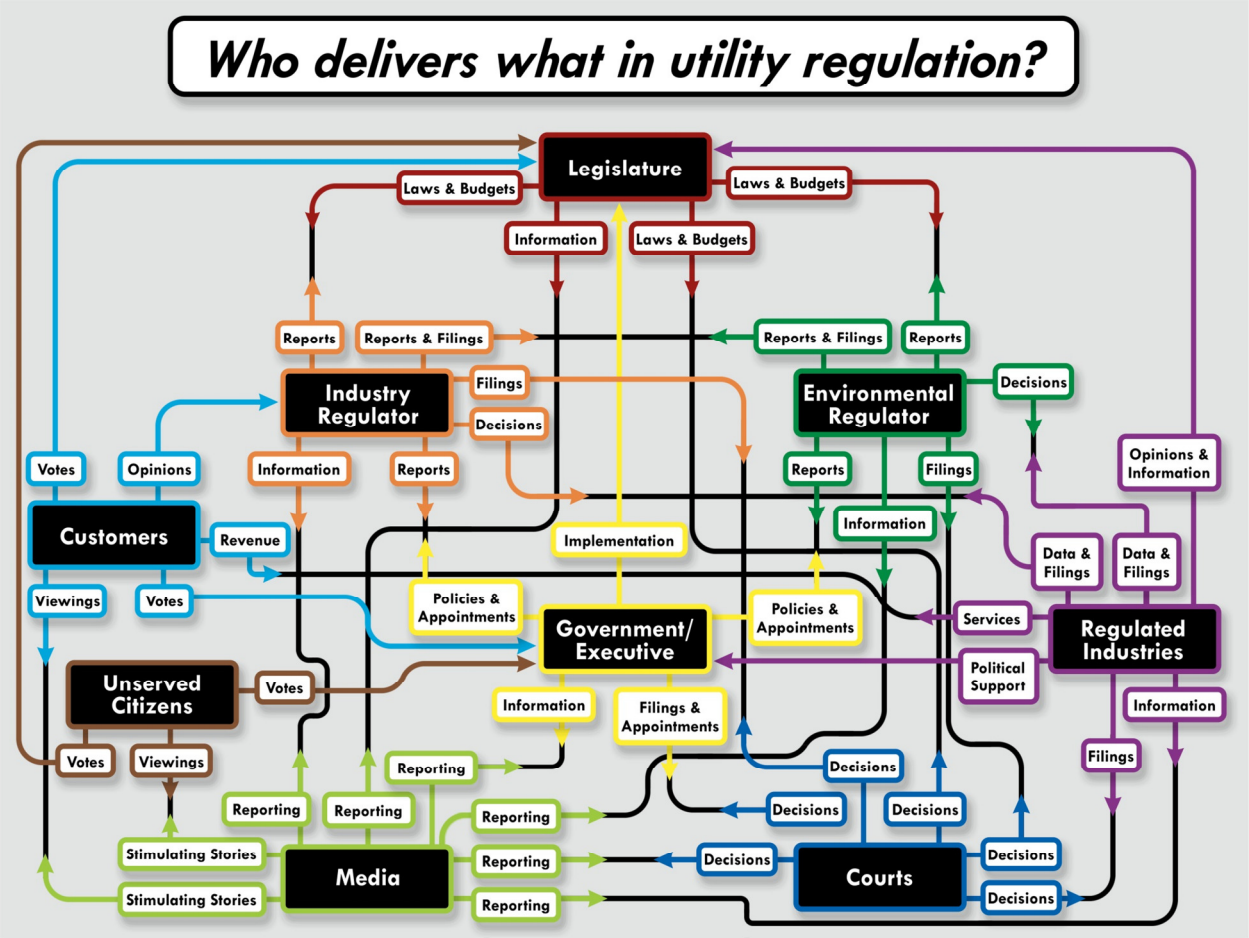


Table 2. Technical and Adaptive Challenges[16]

Kind of Challenge	**Technical**	**Technical & Adaptive**	**Adaptive**
Problem Definition	People know the problem and are ready for solutions	People know the problem and are ready for solutions	Requires learning because people disagree on whether there is a problem and the nature of the problem
Solutions and Implementation	People know the problem, are ready for solutions, and accept the technically correct answer	Requires learning because people disagree on what is most important in possible solutions	Requires learning because people disagree on what is most important in possible solutions
Primary Locus of Responsibility for the work	People in authority task the work to technical experts	Stakeholders engage in adaptive work. People in authority provide resources and space for learning and implementation.	Stakeholders engage in adaptive work. People in authority provide resources and space for learning and implementation.
Sample Tools and Approaches	• Delegation to experts (accounting, economics, law, etc.) • Provide resources and training for subject matter experts • Traditional hearings and legal proceedings • Negotiations	• Get on the balcony • Exercise leadership to help stakeholders see problems rather than "solving" the problem • Think politically about stakeholders' relationships and perspectives • Manage stress levels	

[16] Jamison, Rowe and Perlman (2005).

Table 3. Illustration of Adaptive Challenges in Regulator Formation

Illustrative Responsibilities	Before Agency		After Agency Implemented		
	Policy	Operator	Policy	Regulator	Operator
Delineate Markets and Structure	✔		✔	✔	
Set Performance Standards	✔			✔	
Monitor Performance	✔			✔	
Evaluate System	✔		✔		
Define Sector Vision	✔	✔	✔		✔
Determine Prices	✔	✔		✔	
Choose Technologies	✔	✔			✔
Determine Investments	✔	✔			✔
Establish Market Rules		✔		✔	
Conduct Public Hearings	✔	✔		✔	
Provide Due Process				✔	
Negotiate Purchased Power	✔			✔	✔
Receive Consumer Complaints		✔		✔	✔
Provide Media Information	✔	✔	✔	✔	✔

Table 4. Illustration of Adaptive Challenges in Industry Reform

Illustrative Responsibilities	Before Reform			Learning Phase		
	Policy	Regulator	Operator	Policy	Regulator	Operator
Define Sector Vision	H			L	L	M
Evaluate Reg. System	H	L		H	M	M
Delineate Markets and Structure	L	H		L	L	M
Establish Market Rules		H			M	M
Set Performance Standards		H			L	H
Ensure Financial Performance		H	H	L	L	H
Determine Prices		H	L		L	M
Provide Transparency		H			M	
Provide Due Process		H			M	
Choose Technologies		L	H			H
Determine Investments		L	H			H
Conduct Public Hearings		H		H	H	H
Review Experiences		M	H	H	H	H
Discuss Roles				H	H	H