Adapting Infrastructure Regulation: What Should Be the Boundaries of Coercive Power?

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Abstract

Today's utility regulation is marked with change, including the internationalization of infrastructure, challenges to traditional utility business models, the decline of the natural resource model for water, emerging market structures that are sometimes weakly competitive, and companies such as Google that aspire to be the dominant managers of the world's information, computing, and network resources. This paper outlines an adaptive approach for developing regulatory responses. The adaptive framework recognizes that issues can be divided into two basic groups: technical and adaptive. Technical challenges are those for which there is general agreement on the existence and nature of the problem, the alternative solutions are clear, and work can be performed by subject matter experts. Adaptive challenges arise when fundamental changes in the environment call for a group to rethink basic goals and strategies.

The model has as one of its goals the achievement of proper coherence, which is the proper alignment between institutions, technologies, and sector practices. When change is the norm, coherence should be dynamic with greater emphasis on liberty of ideas and less emphasis on static notions of efficiency and alignment. An adaptive regulatory system would be one that decentralizes control, permits multiple moving parts, allows for asymmetric treatment of service providers, facilitates deliberate experiments, and emphasizes information sharing.

Introduction

The bread and butter of utility regulation have been the use of the coercive power of the state and of voluntary economic incentives to induce service providers to provide sufficient and economical service. In some instances it was also desired that service non-discriminatory, but there are times when discrimination is desired by industry regulators and policy makers. For example it is not unusual in the United States for utilities to have special tariffs for important customers, such as the government. But these tools were designed for times in which the desired outcomes were well understood and easy to observe. For example regulators would use coercive power to penalize operators for failing to meet performance objectives, such as service quality or service availability. More recently regulators have begun using incentive mechanisms, such as price cap regulation, that are designed to provide economic rewards to utilities when they use private information to the benefit of customers.

But today's utility regulation is marked with change rather than well known and observable outcomes: Infrastructure is becoming increasingly international, challenging traditional regulatory boundaries. Emerging carbon policies and command and control mechanisms for promoting renewable energy are altering the economics of the entire value chain. Some smart grid proposals threaten to dissolve the traditional electric utility business model. Many parts of the world are experiencing the end of being able to harvest fresh water from nature and will need to manufacture it. While wireless telecommunications continues to experience robust competition in most places that have fully liberalized, emerging fixed line broadband markets are a mixture of monopoly and limited competition. Furthermore companies such as Google are aspiring to be the dominant managers of the world's information, computing, and network resources.

How should policy makers, utility regulators, service providers, and other stakeholders respond to these tides?[1] This paper outlines an adaptive approach for developing regulatory responses. The adaptive framework recognizes that issues can be divided into two basic groups: technical and adaptive. (Heifetz, 1994, pp. 3-8, 35) Technical challenges are those for which there is general agreement on the existence and nature of the problem, the alternative solutions are clear, and work can be performed by subject matter experts. For example, a number of utility regulators in the United States are considering electric utility rate cases. The issues involved are demanding and complex, but the challenges are

[1] To conserve on words, I will hereafter use the term "regulation" to cover both policy and regulatory issues.

largely technical in the sense that there is general agreement that the issues are how much, if any, a company's overall price level should change, and how will any price changes be distributed across customers. (Jamison, Rowe, and Perlman, 2005) In contrast, adaptive challenges arise when fundamental changes in the environment call for a group to rethink basic goals and strategies. For example, current beliefs about climate change are forcing some regulators to re-evaluate commitments to affordable energy and to market solutions for emissions control. An adaptive approach to solving regulatory problems engages regulators, service providers, customers, and other stakeholders in processes of experimentation and dialogue to clearly understand the changed environment, make tradeoffs between old and new aspirations, and jointly discover new approaches.

The remainder of this paper proceeds as follows. The next section describes the concept of coherence for matching regulatory policies and institutions with external conditions. It then reviews the changes occurring in utility markets and argues that the markets are dynamic, necessitating the need for focusing adaptive coherence, which is defined below. The fourth section suggests that regulators should engage in adaptive processes that encourage experimentation. The final section is the conclusion.

Coherence

Regulatory policies and institutions evolve to achieve coherence, which is the proper alignment between institutions, technologies, and sector practices. (Künneke, 2008; Jamison, 2009) This evolution has been experienced several times throughout history. In the United States, state regulation of utilities replaced municipal regulation in the early 1900s and within a few years federal regulation replaced certain aspects of state regulation because technology changes made it feasible for service providers to situate aspects of their operations outside the jurisdiction of the initial regulatory organizations. Recently in the United Kingdom the government merged the operations of its telecommunications regulatory agency and broadcasting regulatory agency to form Ofcom because technology changes had made moot the traditional boundaries between the two sectors.

There are at least five dimensions along which to consider coherence between regulatory institutions on the one hand and technology and industry practices on the other. One is to consider the problem as one of restricting outcomes or pursuing objectives. This *effects coherence* involves ensuring that regulatory institutions' geographic and legal reach are sufficient to accomplish the purposes of regulation, namely controlling market power, ensuring industry stability, redistributing wealth, extracting rents from service providers, limiting opportunism, and overcoming information asymmetries.[2] Outcomes and objectives have been the pragmatic guiding principle determining much of the development of regulatory practices and institutions. An example of effects coherence would be the a ratemaking decision by the Barbados Fair Trading Commission that insulated customers of Cable & Wireless in the nation from possible negative impacts of an organizational change in the company that led to a loss of information about costs incurred to provide service in Barbados. The regulator might not have had jurisdiction over the company's organizational structure, but could exercise its ratemaking authority to require that particular cost information be provided.

Control coherence is the form of coherence articulated by Künneke (2008). He describes coherence as an alignment of regulatory institutions and technological practice, contrasting centralized controls in technology with decentralized control by market mechanisms. The essence of this perspective is that if there is a need for regulatory control of an operation or system, then the regulatory institution needs the geographic and legal reach to have that control. Such control might be necessary in situations where effects coherence is inefficient or cannot be accomplished. For example, in the case of Internet address conventions, network effects would be lost if there were not general agreement on protocols. Bilateral and multilateral service provider negotiations might have failures, resulting in disruptions. The Economic Community of West African States (ECOWAS) secretariat is an example of control coherence where a network of sovereign states in Africa gave a supranational institution coercive power to oversee the development and operation of a regional transmission grid. (Berg and Castañeda, 2007)

The third form of coherence is *capacity coherence* and refers to the information and expertise of the regulatory institution. There can be situations where a service provider's legal structure insulates certain kinds of information from the regulator's reach. For example, the documentation for certain cost items might be held by an unregulated affiliate or business partner of the regulated operator. If the operator does not have legal authority to obtain the information, the regulator might need to have that authority itself, or at least authority to prohibit the operator from entering into such business relationships.

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[2] See Jamison (2009) for a more complete explanation of these purposes of regulation.

Another form of coherence, *array coherence*, is the number and types of operators with which the regulatory agency engages. Sometimes concerns arise that if a single operator (or set of closely aligned operators) makes up a significant portion of the regulator's work, that the relationship might have significance on regulatory decisions. If the relationship becomes adversarial, the regulator might have difficulty making progress on issues because of poor communications with the operator and the regulator might lose objectivity. On the other hand the regulator or government might be captured by the singular industry interest. Furthermore, as Lyon and Li (2003) point out, regulating a number of companies gives the regulator an opportunity to establish its credibility.

The final form of coherence is *dynamic coherence* and refers to the ability of the regulatory-provider-customer system to adapt. Two types of forces drive the need for adaptation. The first type is the external forces that are outside the control of the regulatory institutions, industry and customers. Examples would include technology changes, changes in fuel prices, and certain changes in laws, such as general changes in tax or accounting regulations. The other force is the internal dynamics of co-evolution in which changes in some player in the system induces changes in other players. For example, changes in regulatory treatment of nuclear investments in Florida have incentivized electricity producers to expand investments nuclear power. (Holt and Kury, 2009) In practice nearly all changes creating a need for adaptation would be a combination of external and internal influences. For example, a change in smart grid technology might have no impact on a utility service area absent regulatory change that allows adoption, investment by the utility in certain aspects of the technology such as smart metering, and customer acceptance of the roles that customers might need to play in making energy choices.

Changes in Utility Markets

This section briefly reviews five changes that imply a need to focus on dynamic coherence. The first change is the increasing internationalization of infrastructure. Internationalization of infrastructure occurs through interconnections or links that lead to interactions. (Jamison, 2009) These interconnections take many forms. Physical interconnections in infrastructure include connections for telecommunications traffic, electricity transmission, natural gas pipelines, and liquefied natural gas shipping. The cross-border issues include technical standards, geographic locations, payment amounts, payment systems, transmission rights and obligations, and enforcement of contracts or other agreements. Logical interconnections are those related to the intelligence and controls across the physical system. Telecommunications numbering and Internet naming conventions would fall into this category.

Financial interconnections include several situations. An infrastructure firm's activities in one country might affect its performance in another country. An operator might seek to hide or double report costs or revenues through transactions with international affiliates. It could also be that there are scale economies in financing operations and that these economies can only be achieved if the operator serves more than one country. The cross-border issues include ring fencing the finances of domestic operations, regulatory access to and use of financial and accounting information.

Strategic interconnections are those where decisions across jurisdictions are strategically interrelated. Recent examples include the provision of natural gas in Eastern Europe where contract decisions appear to have been tactics in larger economic and geopolitical strategies. Policy interconnections include spillovers of jurisdictional decisions. For example liberalization of telecommunications in Western economies led to the creation of multiple global telecommunications firms that desired to interconnect with networks in non-liberalized markets, resulting in telecommunications liberalization in these other economies.

Internationalization of customers led to changes in infrastructure companies, in particular telecommunications where operators sought to expand into multiple countries so as to have network footprints wherever their multinational customers had business locations. Environmental interconnections are largely spillovers and externalities related to environmental impacts of infrastructure decisions, such as acid rain, greenhouse gases, and natural resource extraction.

Environmental policy is another factor affecting electric utilities and their regulation. In recent times the most prominent of these policies relate to climate change and include ideas such as a carbon tax, carbon cap and trade, and renewable portfolio standards (RPS). The carbon restrictions are designed to change the economics of electricity provision, incenting generators to adopt less carbon intensive energy sources than traditional coal, natural gas, oil, and the like, and perhaps to incent customers to decrease their electric consumption.[3]

Some generators are directing new investments towards nuclear power as a solution for base load, but it raises its own environmental concerns, including issues of location and waste disposal. Other investors, including taxpayers, are financing the development of renewable energy, including wind, solar, and biomass. But these energy sources also raise environmental concerns, including placement of new transmission facilities, potential polluting effects of growing plant materials for bio fuels, and the water demands of producing the plant materials. For example, a recent study at the University of Florida found that four ethanol crops — corn, sugarcane, sweet sorghum and pine — yield net energy, meaning they are viable for replacing fossil fuels in Florida and Georgia, but the estimated freshwater requirements would increase by 25 to 100 percent the total freshwater withdrawals for all human uses reported in the two states for 2000. (Evans and Cohen, forthcoming) Furthermore renewable energy may raise unforeseen environmental concerns because they have never been developed and deployed on scales contemplated by some RPS policies.

These environmental policies are changing the risk profiles of electric generators, transmission providers, and distribution companies. For example, concerns over climate change policies have prompted some generators in the United States to pursue nuclear power options. But the long lead times for constructing nuclear plants have made some investors unwilling to take the risks, which include uncertainty over construction costs, operating costs, regulatory treatment, future climate policies, technology change, and demand. This investor reluctance has led some states to attempt to reduce risks to nuclear plant developers or re-allocate them to customers and to improve expected returns on investments. For example, Florida's power generation is subject to traditional rate-of-return regulation, but regulators can annually approve ongoing investments in nuclear power before plant additions actually go online. (Holt, Sotkiewicz, and Berg, 2008; Holt and Kury, 2009) The uncertainty of which carbon policies may be adopted by various countries may be resolved over time, but the

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[3] Decreases in electricity consumption would be needed to decrease carbon emissions from generation if technology and economic restrictions effectively prohibited generators from selling the same amount of electricity while meeting the carbon emission standards.

magnitudes of the carbon taxes and the prices emerging from cap and trade schemes will remain uncertain, in part because they will be determined more by political forces than by economic forces.

Smart grid represents a set of technological, business, and regulatory changes that could transform the utility business model. Opinions vary on what smart grid is, ranging from ideas as simple as smart metering to ones such as plug in hybrid vehicles, which could include third party aggregators, battery storage systems, and automated load management. (Holt et al., 2009) These differences in opinion as to what smart grid represents, coupled with the technology, regulatory, and demand uncertainties create a significant amount of risk for utilities, customers, and other businesses that might contribute to smart grid.

Aside from the changes in electricity, there is increasing recognition that many parts of the world are experiencing the end of an era of being able to harvest fresh water from nature and will need to manufacture it. According to the World Health Organization and the United Nations Children's Fund (2008), approximately 15 percent of the world's population does not have access to improved drinking water and a recent study by the Center for Strategic and International Studies (2009) estimated that within 20 years over half of the world's population will live in water stressed regions. One of the consequences of water declining as a natural resource as been the commoditization of water resources. Treating water as a tradable good rather than a gift of nature raises issues of property rights over surface water and subterranean water resources that cross geographic property and national boundaries. (Baillat 2005) Rethinking these rights changes the cost of water, raises pricing issues for water utilities, and challenges traditional notions that all aspects of water utilities are natural monopolies.

The changes in expectations for utility markets are not limited to electricity and water: There is evidence that the competitive paradigm for telecommunications may falter in some situations for broadband. Wireless telecommunications continues to experience robust competition in most places that have fully liberalized the market. The competition promotes network expansion and economic development. (Waverman, Meschi, and Fuss. 2005; Lee and Marcu, 2007) Competition also promotes broadband development in fixed line (Lee and Marcu, 2007), but competition in fixed line broadband is generally limited to two technologies – DSL and cable modem – with some traditional telephone providers such as Verizon choosing fiber to the home options over DSL. But these technology options mean that facilities based competition is limited to two traditional network providers: traditional telephone companies and cable television companies. In countries where cable television is not very well developed, facilities competition can be quite limited.

This market structure for fixed broadband raises two issues. The first issue is whether fixed and wireless broadband technologies are in the same market, meaning that they are substitutes for each other. This is still an open question. The second issue is: If competition is limited in broadband markets is limited, what is the most appropriate regulatory response? Options range from retail price controls, to regulation of market structure (through subsidies unbundling, resale, access to essential facilities and the like), to acceptance of the imperfect competition. Which of these approaches might be optimal is unknown and could vary across markets and across jurisdictions.

Finally, there are potential new players in the utility markets that could bring about fundamental changes that are hard to anticipate. For example, companies such as Google are aspiring to be the dominant managers of the world's information, computing, and networks. Google's interests were initially in information management and moved into telecommunications network management. Now Google is developing plans for being a player in smart grid. If the company is successful, it could become an information and networking utility with significant market power and political influence.

Adaptive Processes for Regulation

As a practical matter, it is impossible to achieve any form of coherence other than dynamic coherence when utility markets are in the degree of flux that we are now experiencing. What then is the appropriate regulatory response? It would appear that regulation should follow two potentially conflicting paths: A path of stability so that suppliers and customers can make long term decisions and a path of experimentation so that stakeholders and regulators can learn and make necessary tradeoffs once learning has occurred.[4]

How can regulators promote a system where people grow in knowledge together so that the learning embedded in institutions and the system of institutions is consistently greater than individual

[4] For a more complete description of a regulatory approach for adoption, see Jamison and Castañeda (2009).

knowledge and is able to adapt when circumstances change? Jamison (2009) explained that the "appropriate answer to this question is to create or allow a system of experiments in institutional design and regulatory rules that test assumptions and conclusions, and that examine new ways of addressing known problems." Such a system would facilitate adaptive learning, which is the creation of new mental and institutional frameworks that narrow the gap between existing beliefs and reality (Heifetz 1994: 244-245; North 2005: 66-67).

For example, Chile and Argentina led the world in electricity reforms, but made mistakes that several European countries learned from and, for the most part, avoided repeating. The United States learned as well, but as evidenced by the California electricity crisis, did not learn well enough and created a new set of mistakes that others observed and learned from. Likewise the evolution of regulatory institutions in the United States provided lessons regarding ratemaking authority and independence, the initial understaffing of U.K. electricity regulator provided lessons on developing agency expertise to avoid significant information asymmetries, and New Zealand's attempt to rely solely on competition law illustrated the importance of expert regulatory agencies and ex ante regulation of markets with powerful incumbents. (Jamison, 2009)

Adaptive learning occurs through experiencing and analyzing the results of decisions that challenge existing norms. For example, at one time public ownership was favored around the world. But then privatization was tested, and the results were positive. Consequently, the public ownership standard gave way to a private ownership model. After it became clear that equity markets would not finance all of the infrastructure that some policy makers and multilateral institutions believed were needed, that institutional weaknesses led to inefficiencies regardless of the form of ownership, and after it became clear that private participation was only a piece of a larger system of reform efforts, many countries began developing and testing various forms of public-private partnerships.

Jamison (2009) used the term co-evolution to describe the systems learning that occurs when institutions interact and adapt, with some becoming extinct and others being formed anew. Systems learning is the sum of adaptive learning within organizations and the adaptations that occur in how organizations interact. He identified five institutional characteristics that are important for a system of regulatory and government institutions, service providers, customers, and supporting institutions such as think tanks to engage in effective adaptive learning.

The first property was decentralized control, which speeds experimentation and can align economic rewards with decision making relative to more traditional economic regulation. With centralized control an experiment would need permission of the formal authority figure. This permission would add costs and reinforce the status quo because the party desiring to experiment would bear a burden of proof in seeking permission. Where might control be decentralized today? Mechanisms for addressing concerns over carbon emissions, smart grid systems, and approaches to renewable energy are examples where experiments are being conducted through research consortia that include industry, academics, and customers, and sometimes include regulatory institutions.

A second property was multiple moving parts. Concepts of static efficiency often imply that industrial organization should emphasize exploiting scale economies and limiting transaction costs. However, opportunities for adaptive learning are greater with greater numbers of decision making units, implying that there are times when production economies should be sacrificed for potential dynamic gains. Current climate change legislation in the United States Congress would violate the multiple moving parts criteria because it preempts state experiments with carbon restriction mechanisms and renewable energy requirements.

Differing treatment was the third property. It means that asymmetric treatment of service providers should be used to facilitate learning about how service is affected by regulatory rules. The United States used this path for learning about broadband when it had unbundling requirements for telephone companies but not for cable television companies, but abandoned this approach when it declared broadband to be an information service and not a telecommunications service. Without passing judgment on whether unbundling was an important policy, the choice of symmetric treatment of different types of operators precluded what might have been some important learning about alternative ways of facilitating competition in fixed line broadband.

Support of deliberate experimentation was the fourth property. In some ways the United States is doing well with experimentation for smart grid as universities, service providers, and other stakeholders are conducting numerous trials funded in part by the Department of Energy, the National Science Foundation, and industry. To facilitate such experimentation, the regulatory system should make it easy to suspend rules or establish temporary rules, institute processes for information gathering and analysis, and engage in dialogues that promote the development of new ideas for experimentation.

The National Information Infrastructure initiative launched by the Clinton Administration in the United States had some such features. It included a variety of grant mechanisms that promoted localized initiatives and forums for generating new ideas. The George W. Bush Administration's hands off approach to broadband had a similar effect, making it possible for initiatives such as Connected Nation and One Economy to create and refine new ways of promoting broadband that had not been thought of by federal regulators.

Information sharing is the final property of a regulatory system that promotes adaptive learning. This includes traditional sharing systems, such as conferences, meetings, and reports, but the system should be deliberate in getting outside the box to engage with people who would significantly disagree with status quo and current trends, with groups that have different traditions and cultures, and with its traditional stakeholders but in a dialogue framework that creates new ideas. Regulatory associations might for example devote time to discussions about how jurisdictions differ, how they are the same, and how regulatory decisions affect sector performance.

Conclusion

This paper outlines an adaptive process for regulation during a time of change in utility markets. The model has as one of its goals the achievement of proper coherence, which is the proper alignment between institutions, technologies, and sector practices. When change is the norm, coherence should be dynamic with greater emphasis on liberty of ideas and less emphasis on static notions of efficiency and alignment. An adaptive regulatory system would be one that decentralizes control, permits multiple moving parts, allows for asymmetric treatment of service providers, facilitates deliberate experiments, and emphasizes information sharing.

It is a paradox of our time that utility agencies play such a central role in changing a system that they were created to stabilize. Utility regulators' traditional and central responsibility is to provide a predictable environment, in which investors, operators, and customers can make long-term decisions with confidence that short- term political goals will not impose uncertainty. However, the utility regulator must adapt the regulatory system to economic, social, and technological realities that are changing rapidly in directions that are at present unknown. This uncertainty makes it hard for regulators to plan and put at risk benefits that stakeholders have come to expect from the regulatory process. This makes today's utility regulation perhaps as much a question of leadership as it is a question of proper economics, accounting, finance, engineering, and law.

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