NRRI 01-11

E-REGULATION

Dave Wirick
Associate Director

The National Regulatory Research Institute
1080 Carmack Road
Columbus, Ohio 43210
Phone: 614-292-6719
Fax: 614-292-7196
www.nrri.ohio-state.edu

August 2001

This report was prepared with funding provided by the National Association of Regulatory Utility Commissioners (NARUC). The views and opinions of the author do not necessarily state or reflect the views, opinions, or policies of the NARUC, NARUC-member states, or the National Regulatory Research Institute.

EXECUTIVE SUMMARY

In an era of high demand for improved efficiency and effectiveness for government at all levels and for improved regulatory processes in particular, it is assumed by many that modern electronic information systems can provide better integration between government, business, and the public and that the result of their application will be the provision of enhanced services and improved pursuit of the public interest. Proponents of electronic government point to its ability to improve public interaction and satisfaction with government services, make more efficient the interaction between business and government, allow government to more efficiently interact with its employees, and allow government agencies to communicate more effectively with one another by cutting across jurisdictional boundaries.

To date, public utility regulatory agencies have focused their information systems development on supporting commissioners and staff through effective internal networks and electronic communication, website development and communication of commission documents to the public, tariff filing, customer complaint tracking and management, docket management, and, in a few cases, electronic filing and geographic information systems. Chapter 1 describes some leading state initiatives with these systems.

Despite these initiatives, the progress of regulatory agencies to adopt more extensive electronic information systems (e-regulation) has been slower than some would hope. That progress has been slowed by lack of resources, restrictive legal processes and filing requirements built on the requirement for paper filing and document retention, limited information flows under traditional regulation, slow adoption of electronic information systems by some commission stakeholders, extensive industry change, and the limitations of state-wide information systems planning processes.

An analysis of the communication nodes of the regulatory process leads one to the conclusion that much remains to be accomplished if regulatory agencies are to realize the full potential of electronic information systems. Unfortunately, those systems come with costs, which include the direct financial costs and other, less

obvious costs, including the potential for failure, increased total system costs, hidden and distributed staffing costs, security breaches, system obsolescence, user dissatisfaction, failure to integrate information systems into the strategic direction of the agency, and system and vendor dependence. Because of these costs, it is not appropriate to invest in information systems because everybody else is, to save paper, to create the appearance of responsiveness, or because they are there.

There are, however, good reasons to explore the expanded use of electronic regulatory information systems. Those reasons are to simplify and increase access to information, make the regulatory process more public and transparent, improve the quality of decision making, support the attainment of the commission's mission, improve regulatory efficiency, improve satisfaction with the regulatory process, and meet legislative and executive mandates. The challenge for regulators will be to make the business case for investment, acquire the necessary resources, identify the necessary expertise, get the attention of leaders, get buy-in from stakeholders, and implement those systems.

One of the initiatives being made by several states and the federal regulatory agencies is electronic regulatory filing (ERF). Despite the complications of ERF, given improvements in information technologies, the ubiquity of the Internet, and the potential to save money and improve decision making, ERF may be an eventual and dominant feature of the regulatory landscape.

One of the key ERF issues for regulators is the legal framework for ERF. Fortunately, that legal framework is being addressed by model legislation known as the Uniform Electronic Transaction Act (UETA). UETA, which has been adopted by 25 states and introduced into 18 others, attempts to establish the paper equivalence of an electronic record without affecting the underlying legal rules and requirements. Other key ERF issues are security, the underlying document culture of regulation, filing formats, citation, record retention, official filing dates, filing authentication and validation, document content standards, and document size.

The ERF systems of several states are examined in Chapter 2. Those systems can be generally characterized by the format required for filing. Variants are paper filing with electronic conversion, submission of paper equivalents (PDF),

the use of multiple submission formats with conversion by the commission, and SGML/XML. XML is a technology adopted by the World Wide Web Consortium to enhance the ability of the web to exchange and process data. It allows for the creation of customized "tags" that label elements within documents and data sets so that they can be used across systems. It creates a standardized vocabulary and blueprint for documents. The National Electronic Commerce Coordinating Council, which is a consortium of a variety of national government associations, has called upon governments at all levels to "aggressively pursue" XML for information exchange. The legal community, healthcare, banking, education, human resources and other professional fields are already employing or studying the use of XML to facilitate profession-wide data interchange.

Building the business case for ERF requires far more than the simple argument that it will reduce costs. Reducing costs through ERF requires minimizing system development costs, generating a rapid return on investment, not pushing costs upstream, reducing staffing and storage costs, and minimizing dual operation time. Wider goals for ERF--goals that might support the business case--include reducing costs, improving regulatory effectiveness, and improving user satisfaction. Achievement of those more complex outcomes requires more complex implementation initiatives.

States implementing ERF will need to make tradeoffs between cost and system complexity and functionality. ERF costs can be reduced by choosing a single input standard like PDF, building on the lessons learned from others, pilot testing and phasing in ERF systems, using iterative planning methodologies and development processes, and using in-house resources where possible.

While the regulatory information systems discussed thus far are valuable and the product of hard work and the expertise of commission staff, for the most part they automate existing commission processes and modestly change the way commissions manage information. If information systems are to substantively enhance the regulatory process additional applications are necessary. Chapter 3 of this report details three potential additional information systems applications that may have the potential to substantially change the way in which regulatory agencies

perform their roles or enhance decision making processes. Those additional applications include:

- Knowledge management, which includes data warehousing and mining, text warehousing, and text mining. These systems would also be augmented by more extensive use of XML.
- Electronic facilitation of collaboration

- Regulation by information, which exploits the ability of information to serve regulatory functions by combination of the capabilities of knowledge management and collaborative support systems. This system would establish the equivalent of an electronic library.

- The facilitation of utility market operations, which includes improvements in EDI/OSS, creating "smarter" networks, and "autonomous" markets

Unfortunately, for sophisticated information system applications, planning and execution of information systems are not easy in the best of times. The complexity of systems increases if the system is linked to the strategic direction of the organization and other initiatives, affects more people with varied attitudes toward change, and takes longer to realize benefits. That complexity can be offset by good planning.

Information systems planning is a complex endeavor that calls for a variety of activities at a number of levels of the organization. All too often, public sector information systems planning models are deficient; those deficient models include budget-cycle planning, sequential replacement planning, next-technology planning, and "one-off" planning. There are at least four better planning models that are discussed in Chapter 4; they are systems development life cycle, gap analysis, benefits realization, and extreme programming, a model that has been adopted successfully by the Illinois Commerce Commission.

In addition to the difficulties of systems planning, commissions face several information systems management issues that may further inhibit their ability to make optimal use of information technologies. Those issues are the recruitment and retention of information systems staff, the productive use of consultants, the organization of the information systems function, and information systems funding.

Because regulatory issues increasingly cross traditional jurisdictional boundaries, because of the complexity of information systems, and because of the importance of information to the regulatory process, if regulatory commissions are to make optimal use of information systems, regulatory agencies will need to coordinate their efforts and cooperate in the development of systems. It makes sense in these circumstances for commissions to pool their resources and seek solutions, agree on standard data formats, and, perhaps, agree to collect national data. A national effort to coordinate the development of regulatory information systems could, among other things, conduct research and analysis, encourage dialogue among stakeholders, develop recommended architectures, increase awareness, identify low-cost options, develop templates for system development and implementation, provide assistance to commissions, consider issues of access by all segments of society, develop a regulatory version of XML to allow national data sharing, compile best practices, and develop valid cost-benefit arguments for system application. Examples of coordinated information system initiatives are available; they include development of electronic data interexchange (EDI) standards by a number of states, state government development of statewide architectures, and the "Uniform Regulation Through Technology" initiative of the National Association of Insurance Commissioners.

TABLE OF CONTENTS

TABLE OF CONTENTS – *continued*

LIST OF FIGURES

FIGURES

LIST OF TABLES

TABLES

FOREWORD

Rapid and unending changes in the utility sector have been an impetus in promoting changes in regulation. This report develops and analyzes the concept of e-regulation as a regulatory innovation. It looks at the promise and realities of e-regulation, both in terns of implementation and big picture issues. It is a report I am sure you will find to be indispensable.

Raymond Lawton
Director
August 2001

ACKNOWLEDGMENTS

The author would like to thank those who took the time to review drafts and provide helpful comments: Jeff Pillon, James Spiers, Mike Porter, Ernest Pages, Vivian Witkind Davis, and Ray Lawton. The author is also indebted to those state commission staff persons who spent valuable time sharing their expertise with him. They include the staffs of the Public Utility Commission of Ohio, the Michigan Public Service Commission, the Illinois Commerce Commission, the California Public Utilities Commission, and the New York State Public Service Commission. Finally, appreciation is expressed to Carmell Brown, who performed the final formatting of the report and considerably improved its appearance.

Finally, the author would like to acknowledge the efforts and the talents of the information systems professionals at state commissions who have worked tirelessly to enhance our abilities to communicate with one another. They are a vital component of the regulatory community whose importance will surely increase as information technologies become even more central to the regulatory process.

CHAPTER 1

THE APPLICATION OF INFORMATION TECHNOLOGIES TO PUBLIC UTILITY REGULATION: PROMISE AND PERIL

The Government-Wide Transition to E-Government

In an era of high demand for improved efficiency and effectiveness for government at all levels, it should come as no surprise that the imperative to provide a more integrated approach to governing and services is on the lips of nearly every elected official.[1] Central to that drive by elected officials are the assumptions that modern electronic information systems can provide better integration between government, business, and the public and that the result of the application of electronic information systems will be the provision of enhanced services and the improved pursuit of the public interest.

In some cases, the words of elected officials have been translated into targets for the implementation of forms of electronic government (e-government). Australia has established the target of having all appropriate government services delivered via the Internet by 2001; the United Kingdom has established a target of 100 percent of government services carried out electronically by 2005. The State of Maryland has established target dates for the provision of government agency information and services to the public via the Internet; 80 percent must be available by 2004.[2]

The dominant technologies of the age are information processing and communications, and because the heart of government has always been the processing of information and communication with those who are governed, the new

---

[1] National Electronic Commerce Coordinating Council (NECCC), "An Introduction to XML's Potential Use Within Government," December 2000, 11. The NECCC is an alliance of the National Association of State Auditors, Comptrollers and Treasurers, the association of Chief Information Officers in the States, the National Association of State Procurement Officials, and the National Association of Secretaries of State in conjunction with the National Governors Association, the National Association of State Chief Administrators, the Information Technology Association of America, and the National Automated Clearing House Association.

[2] NECCC, "Critical Business Issues in the Transition to Electronic Government," December 14, 2000, 13.

technologies and government are intensely intertwined.[3] Proponents of the use of electronic information systems, and there are many, point to the ability of e-government to improve public interaction and satisfaction with government (G2C), make more efficient the interaction between government and business (G2B), and allow governments to more efficiently and effectively interact with their employees (G2E) and communicate more effectively with other governments (G2G).[4] Proponents of e-government seek to revolutionize government by cutting across agency boundaries and creating one-stop-shopping for citizens.[5]

Governments also expect to save money; studies now indicate that governments are saving up to 70 percent by moving services online.[6] In pursuit of these aims, the Gartner Group estimates that e-government related expenditures will rise from $1.5 billion in 2000 to over $6.0 billion in 2005.[7]

Governments have adopted an array of strategies to capture these perceived benefits of e-government. In addition to the activities of individual state and federal agencies to implement new information technologies within their domains, they have created joint endeavors between business and government to encourage the e-conversion of government. States have developed government-wide information technology plans and formed government-wide consortia to coordinate technology procurement and management (e.g., the Governor of Illinois' Technology Office and the Georgia Technology Authority). In a more general sense, some argue that the adoption of electronic communications and information systems throughout substantial portions of society has itself led governments toward deregulation, privatization, governing at a distance, dismantling of interventionist policies, the creation of policy networks, and the reorganization of government and policymaking.[8]

---

[3] Paul Frissen, "The Virtual State: Postmodernisation, Informatisation, and Public Administration," in Brian D. Loader, Editor, *The Governance of Cyberspace: Politics, Technology, and Global Restructuring* (New York, NY: Routledge, 1997), 111.
[4] NECCC, Symposium 2000, "E-Government Strategic Planning, A White Paper," December 13, 2000, 6-8.
[5] NECCC, "Electronic Commerce: A Blueprint for States," December 1999, 11.
[6] NECCC, "Critical Business Issues in the Transition to E-Government," 5.
[7] NECCC, "E-Government Strategic Planning," 16.
[8] Paul Frissen, "The Virtual State: Postmodernisation, Informatisation, and Public Administration," in Brian D. Loader, Editor, *The Governance of Cyberspace: Politics, Technology, and Global Restructuring*, 116.

The net result of these forces and activities is an ongoing and relentless push for government at all levels to adapt to an emerging electronic society and transform its ways of doing business to harness the potential benefits of electronic information and communication systems. The ultimate impact of e-government on the citizenry is yet to be determined, but public utility regulation, which is already being transformed by market changes, is not likely to be immune from the effects of information technologies.

The Purposes of This Report

This report attempts to unravel some of the issues embedded in the application of electronic information systems to public utility regulation and to provide guidance and ideas to state policy makers in their pursuit of e-regulation. It is not intended to be a paean to the likely benefits of electronic information systems nor is it a justification for moving slowly or not at all. It describes the application of information systems at public utility commissions. It explores in some detail electronic filing, a generic term applied to electronic handling of information at commissions, in all of its variations, its pros and cons, its design attributes and issues, and its potential. It identifies and describes four additional vectors for information system application to public utility regulation, with the hope that one or more may prove to be the "killer app" that enhances regulation and creates a useful and credible fit between regulation and its current environment. It considers issues in public utility commission information systems management including systems planning with special attention to improving and shortening the planning cycle, staffing, managing complex information systems projects, funding, and the social and ecological aspects of information system installation and use.

Lastly, the report presents a recommendation for bringing together a "community of stakeholders," for which models exist, at the national level to consider information system policies, standards, and architectures while allowing adaption of systems to fit state and local circumstances. Most simply, this report attempts to lay out useful ideas, directions, and issues while at the same time "avoiding the

hyperbole of both the Utopian exhortations of the cyber-libertarians and the dystopian prophesies of the digital Luddites."[9]

Public Utility Commission Application of Electronic Information Systems

Current public utility regulation and the movement toward industry restructuring are, to some extent, creatures of the electronic information revolution and the ability of new technologies to rapidly move the information necessary for more-competitive market operations. Therefore, it would seem appropriate that public utility regulators make every attempt to capitalize on those forces, which have so significantly impacted their environment.

Thus far, public utility regulators have moved carefully and deliberately to embrace electronic information systems. State and federal regulatory commission websites have become important tools for providing commission information, like the status of dockets and commission orders, to the public and to stakeholders. Access is available in some cases to commission databases and to consumer complaint statistics. Some state public utility commissions, both U.S. federal public utility regulatory commissions (the Federal Energy Regulatory Commission and the Federal Communications Commission), and the Canadian National Energy Board (NEB) have pursued variations of electronic filing, which will be discussed below.

Typically, commission information systems development and resources have focused on seven system applications at differing levels of investment:[10]

1. Support of commissioners and commission staff through internal networks, e-mail, appropriate and current software, upgraded equipment, and enhanced ability to collect and analyze data.

---

[9] Brian D. Loader, Editor, *The Governance of Cyberspace: Politics, Technology and Global Restructuring* (New York, NY: Routledge, 1997), xii.

[10] Because the authority for regulation of transportation varies at public utility commissions, this report does not address the application of information systems to transportation regulation. Where commissions have authority for the regulation of transportation, a major focus of information systems use has been on one-stop-shopping and uniformity of systems through the Commercial Vehicle Safety and Information Systems (CVISN), which is sponsored and partially funded by the U.S. Department of Transportation.

2. Website development and "webcasting" (i.e., provision of real-time audio and video over the Internet) of commission proceedings. The Gartner Group suggests that websites fall into one of four stages: Presence, Interaction, Transaction, or Transformation.[11] Regulatory commissions are largely in stage two having passed successfully through stage one. The provision of commission information to the public is a sizable undertaking. For example, the California Public Utilities Commission is required by law to publish proposed decisions, decisions, rulings, agenda materials, docket information, and general orders on its website. That requires the publication of about 300 documents a month, which are retained indefinitely by the system, plus information about 500 cases per year and 700 proceedings. Information is available in three formats (PDF, Word, and HTML), and two electronic libraries (one public and one private, protected by a firewall) are maintained.[12]

3. Tariff filing by utilities.

4. Customer complaint tracking and management.

5. Docket management.

6. In some cases, allowing utilities to file materials electronically.

7. In a few cases, implementing geographic information systems (GIS).

The application of these systems by state regulatory commissions is considered at more length later in this chapter and the subsequent one.

Because of the complexity of the roles of state commissions and, in some cases, their size, the development and maintenance of systems that support the current role of commissions has consumed considerable time and resources. An analysis of one state's information systems budget identified more than 87 percent of the budget dedicated to what might be regarded as support of the current internal activities and processes of the commission, which includes docket management and replacement of outdated systems. The remaining 13 percent supports systems that provide information to consumers, protect consumers from intrusion, and initiate elements of electronic filing.

---

[11] The Gartner Group as cited in Public Utilities Commission of Ohio, "2000-2003 Information Technology Plan," September 19, 2000, 21.

[12] California Public Utilities Commission, "Automate Publication of 'Official' Documents to Website," an unpublished PowerPoint presentation and conversation with Kenneth Henderson, Assistant Chief Administrative Law Judge, California Public Utilities Commission.

The internal and process-based systems are important, but, it can be argued, merely apply information technology to traditional commission functions. Put another way, these systems assist commissions accomplish their traditional roles but may not fully leverage the potential of electronic information systems to change the way commissions function.

Despite the initiatives by state commissions to adopt electronic information technologies, their progress has not been as rapid as some might hope. The movement of state public utility commissions to more extensive adoption of electronic information systems has been slowed by a number of factors:

- The lack of resources. The fact that both U.S. federal public utility regulatory commissions and the Canadian National Energy Board have embarked on substantial electronic filing initiatives, whereas most states have not, may indicate that the lack of resources at the state level is critical. Most state commission information system staffs are small and largely devoted to serving the internal commission computer infrastructure and networks.[13] Website creation and expansion of its content has been a significant undertaking for commissions. Scarce resources have been engaged in replacement of outdated and ineffective systems and upgrading existing systems.

- Restrictive legal processes and filing requirements built on the requirement for paper filing and retention of paper records. Public utility commission processes are driven by legal requirements, which until recently and in some states at present, were not amenable to electronic document exchange. Though paper documents, like electronic documents, are subject to potential damage or destruction, storage of paper is, in many cases, the only legally acceptable storage method. Legislation, which will be discussed below, has been adopted or introduced in most states that may make commission processes more amenable to electronic filing, thanks in part to nationally developed frameworks for state legislation created by the National Conference of Commissioners on Uniform State Laws.

- The limited number of providers and limited information flows under traditional public utility regulation. Under traditional ratebase/rate-of-return regulation, the number of providers was smaller than in more competitive markets, and regulatory filing fell into predictable and regular patterns. Filing issues were, therefore, minimized in the closed circle of public utility regulation. Under more competitive regimes, the number of providers has, where restructuring is working well, proliferated and filing requirements

[13] Of 25 responses to a survey conducted by the Massachusetts Department of Telecommunications and Energy in 1998, 18 states reported fewer than 10 information systems staff; 12 reported 3 or fewer.

have changed. In addition, the role of consumers under traditional regulation was minimized. They did not have service choices, and their voice in rate cases was represented by intervenors. There were fewer consumer complaints, and those that were received were less complex. In addition, because issues under traditional regulation could, for the most part, be solved at the discretion of each state, there was less need and desire for national and regional data exchange and information systems coordination.

- Slow adoption of electronic information technologies by commission stakeholders. Commissions are required to be responsive to the lowest common denominator of their stakeholders. If some stakeholders lack access to electronic means of filing and commenting, those stakeholders have, to some extent, "set the bar" for all filers. Barriers to adequate levels of access to electronic technologies, though still a concern, are eroding.

- Extensive industry change. Though industry change has increased the need for state regulatory commissions to consider electronic filing, the process of change has impeded the implementation of electronic information technologies. In this period of regulatory upheaval, it has been difficult to get a firm grasp on the future role of state commissions. Integrating information technologies with the strategic direction of commission regulation has been nearly impossible given the uncertainty of that strategic direction and given the prevalent legislative philosophy that equates more market-based pricing with fewer regulatory resources. In most commissions, change efforts have been focused on commission mission, structure, processes, and organization rather than on the adoption of technologies, other than those efforts employed for internal commission operations and website development.

- State information systems planning processes. State information system planning processes, which will be addressed more fully in a later section, do not often contribute to major projects and significant shifts in information system direction. They are more likely to encourage incrementalism than full reconsideration of the potential benefits of electronic information technologies. State information system planning processes are explored at some length in Chapter 4.

- The lack of information systems standards. Because every state has proceeded on its own to develop unique information systems, the task confronting each state was daunting. Chapter 5 provides an argument for greater regulatory information systems standardization and coordination.

Fortunately for those supporting a move toward more use of electronic information technologies, some of these constraints have begun to relax. The future role of public utility commissions is becoming clearer, legal impediments are being addressed, stakeholders are becoming more advanced in their use of information technologies, and traditional regulation is being replaced by more market-based methods. Issues of ongoing concern, which will be addressed later in this report, are the adequacy of resources (particularly in a cooling economy), planning processes, and regional and national data sharing and filing standardization.

Regulatory Information Systems: Current Status

As noted above, most public utility commission information technology resources have been deployed to upgrade existing systems, support internal commission needs, and enhance the ability of commissions to communicate over the Internet via commission websites. These are important functions, which have required much work and expertise. If regulatory information systems are to realize the promise that some would suggest, regulatory information systems will need to turn outward in their focus.

Figure 1.1 identifies three general functions of regulatory information systems in increasing order of sophistication, cost, and impact: 1) automating commission work, 2) managing (and improving) commission information flows, and 3) enhancing regulation.[14] As one moves from automation of work through information management to regulatory transformation, the strategic implications of the information system and the degree of organizational change required for successful implementation increase.[15] For the most part, commission systems have been focused on the first two functions. The current status of several of these regulatory information systems is considered in more detail. In Chapter 3, the potential for

[14] This hierarchy is adapted from John Thorp and DMR's Center for Strategic Leadership, *The Information Paradox* (New York, NY: McGraw-Hill, 1998). 14.
[15] Ibid.

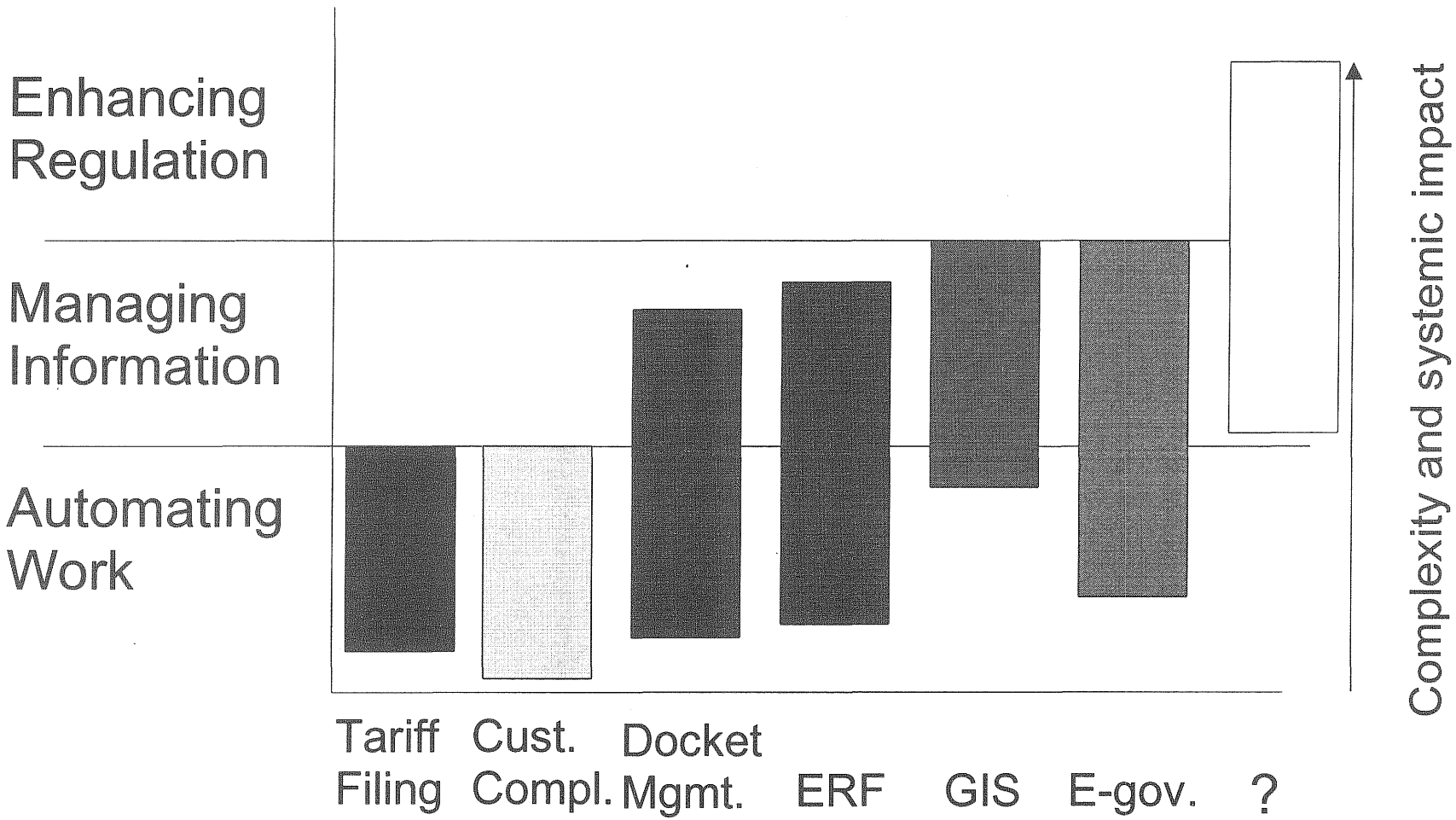

Figure 1.1: The Impact of Regulatory Information Systems

Source: Author's Construct

information systems to address the higher order functions (information management and regulatory transformation) will be discussed.

In some cases, the regulatory systems described below are difficult to separate into such distinct modules. For example, the Missouri Public Service Commission is in the process of constructing an automated solution to commission information needs that will include modules for case management, consumer quality, electronic workflow, a centralized document repository, electronic filing, electronic access to all documents and tariffs, and process redesign.[16] These functions span the automation of traditional functions and new applications of information technology.

Tariff Filing

Tariff filing systems largely and simply automate an existing commission function, that of collecting and posting to a manual system the frequent changes in complex utility tariffs. In many cases, those tariff changes take effect automatically unless the commission elects to hold their application. Those tariff filing systems, either electronic or manual, are typically required by law but are of interest only to an informed and rarified set of stakeholders. In some cases and where state legislation allows, commissions have found a shortcut to tariff filing and have ordered the utilities to make their tariffs publicly available on the utility's own website. From the commission website, a seamless link to the utility site can create the equivalent of a single tariff site.

Where filing with the state is mandatory, some states have established electronic filing systems, which are, despite the apparent simplicity of the function, complex undertakings. For example, in 1996, the New York Department of Public Service (DPS) inaugurated its Electronic Tariff System (ETS) with the goals of saving paper and processing time, reducing storage, and ensuring that the most current version of a utility's tariff is readily available.[17]. That system is not mandatory for utilities but has been embraced by the larger gas and electric utilities. It allows

[16] Missouri Public Service Commission, "Project SASA (Newsletter)," Vol. II No.4, June 2000.
[17] New York Department of Public Service, "Electronic Tariff System," September 1997, Revised June 1998, 1.

submission of tariff "leaves" in a designated word processing format (WordPerfect). Tariff analysts at the DPS receive e-mail notification that a new tariff leaf has been received, review the tariff on-line, and accept it or assign a case number if they do not. If the tariff leaf is accepted by the tariff analyst, it is converted from its word processing format to a searchable database though the word processing version remains the official tariff. Tariffs can be searched and downloaded over the Internet from the DPS website. The ETS was constructed by DPS in-house IS staff.

The DPS is considering (April 2001) the issuance of a request-for-proposals to make the system more user friendly by allowing submission of tariff leaves in PDF (portable document format)[18] instead of a WordPerfect. Though PDF would make filing easier and may attract more utilities to the system, it might reduce the internal analytic capabilities of the system. More discussion of the attributes of various filing formats is provided in a later section of this report.

Customer Complaint Systems

Since the inception of utility industry competition, public utility commissions have seen a dramatic increase in consumer complaints. Generally, a consumer contact with a regulatory commission is not regarded as a complaint unless the consumer has attempted and failed to resolve it with the service provider. Some of those complaints may have been the result of industry transition and the resulting consumer confusion; on the other hand, consumer complaints are common in other regulated but competitive markets. For example, at the Virginia Corporation Commission, which regulates securities, public utilities, financial institutions, and insurance, the largest number of complaints is received relative to insurance, the most competitive of the industries regulated. Public utility service quality erosion has, undoubtedly, also been a factor in the increase in the number of consumer complaints.

[18] PDF is a file format developed by Adobe that requires the free Adobe Acrobat Reader to read. Conversion of documents to PDF requires the purchase of software from Adobe. PDF documents retain their original layout and appearance so that users see them as they were created. More will be said later in this report about PDF and alternatives.

According to public utility commissions, those complaints have also become more difficult to resolve. In some instances, complaints are received about non-jurisdictional entities operating in competitive markets. Those complaints are more difficult to resolve than those received about utilities clearly under the jurisdiction of the commission. Complaints have also become an important data source for commissions, data that might indicate the need for enforcement action or additional policy direction.

Commissions receive complaints via phone, e-mail (many commissions allow e-mail directly from the commission website), mail, and from drop-ins.[19] Commissions apply Automatic Call Distribution Systems to route calls to the next available customer-service representative. They also employ Automated Complaint Tracking Systems (ACTS) programs, which are typically vendor-provided software (mostly database applications), for tracking complaint resolution and storing complaint data. In one case, a state modified a sales management system for managing the flow of consumer complaints. These systems can allow for complaint information to be accessed for analysis in an easy-to-read format.

The Georgia Public Service Commission's (PSC) consumer response data system allows direct transmission of consumer complaints from the PSC to utilities via the Internet; utility responses are transmitted directly into the complaint record and the staff person is notified when the resolution is received from the company.[20] The Ohio Public Utilities Commission (PUCO) is in the process of expanding its customer relationship management system to include e-mail and regular mail contacts and to allow the system to complement the Commission's web presence. The PUCO is also planning to enhance its ability to collect, retrieve, and analyze data concerning customer contacts through the construction of a Consumer Contact Database.[21] Of particular interest is the importation of third-party sources, such as company customer contact data, into the system. Another current issue with regard

[19] One commission cites an increase in drop-ins by the public since telecommunications companies closed local customer-assistance centers.
[20] Fran Sevel, Compiler, *Innovative Excellence: Best Practices in the Consumer Affairs Function* (Columbus, OH: National Regulatory Research Institute, 2000), 33-34.
[21] Public Utilities Commission of Ohio, "2000-2003 Information Technology Plan," September 19, 2000, 24-25.

to commission complaint handling is the ability of systems installed in quieter times to handle the increased volume of complaints and customer inquiries.

At the Illinois Commerce Commission (ICC) the ACTS now allows complaints to be sent to the companies via e-mail and receipt of their confirmations and responses via e-mail.[22] Complaints are shown on a "pending" screen until electronic confirmation is received from the utility advising of receipt of the complaint. If the utility's response has not been received in the requested fourteen days, the complaint is shown as overdue, and the ICC counselor can request that a reminder be sent to the company. Extensions requested by the company can be noted in the system; if the new date passes with no action, an extension reminder is entered for the counselor who took the complaint. This "tickler" system allows ICC staff to manage the time status of pending complaints.[23] The ICC's ACTS also allows for the composition of letters to consumers from pre-composed paragraphs and provides access to these paragraphs for staff to use as talking points for discussing an issue with consumers on-line.[24]

Consumer complaint data collected by the Federal Trade Commission (FTC) is posted to a database through the Consumer Sentinel website and becomes available and searchable to over 170 law enforcement organizations in the U.S. and Canada.[25] A variety of organizations, including more than 30 Better Business Bureaus, the National Fraud Information Center, and at least one state Attorney General, provide complaint data to the system.[26] The Vermont Department of Public Service (DPS) has integrated support materials for complaint-handling staff on its intranet with its complaint handling system so that staff has access to form letters, standard questions, and other materials while they are handling cases. The DPS

---

[22] Francine Sevel, Compiler, *Innovative Excellence: Best Practices in the Consumer Affairs Function*, 39-40.
[23] Francine Sevel, Compiler, *Innovative Excellence: Best Practices in the Consumer Affairs Function*, 2000), 77-78.
[24] Ibid., 45-50.
[25] According to Dr. Francine Sevel, due to legal constraints few, if any, state public utility commissions provide data to this system regarding enforcement actions they have taken against providers of utility service. They are, however, able to access the data because of their enforcement powers.
[26] Francine Sevel, Compiler, *Innovative Excellence: Best Practices in the Consumer Affairs Function*, 79-80.

purchased large monitors so that staff could display complaint data and the intranet open side-by-side.[27]

Docket Management/Case Tracking

Regulatory commissions are process-driven, and, as a result, tracking cases through regulatory processes is an important function. For commission hearings, staff resources must be mobilized, the public and the utilities must be made aware of scheduling, and legislatively proscribed timetables must be adhered to. Though industry restructuring has changed the number and types of industry filings, commissions still track utility rate adjustments, complaints, applications, and filings.

Commissions have applied electronic information technology to docket management (also called case processing) for some time. Existing docket management applications, in some cases, were established in the early 1990s. They may, therefore, require substantial adaptation to be integrated with newer web-based systems.

The Michigan Public Service Commission (PSC) case tracking system (CTS) became operational in 1990. The system it operates on is less flexible than current database systems and does not meet some PSC needs. The CTS generates a variety of reports, including cases opened and closed during a period, scheduled filing due dates, hearings scheduled for a specific time period, a compilation of the status of each active case, and overall statistics on MPSC caseload over an extended period. The system also generates routine reports specific to each case including a service list for each case and an option to print mailing labels for those service lists. MPSC staff enter and post much of the same information to the website, resulting in a partial duplication of effort. By way of comparison, the ICC electronic filing system allows for case status information to be made directly available on its website.[28]

---

[27] Ibid., 87-88.

[28] Michigan Public Service Commission, "Pilot Program Evaluation: Electronic Case Filings," February 2001, 36-37.

Geographic Information Systems (GIS)

Because geography is such an important part of an electric, gas, telecommunications, and water utility's service delivery system, geographic information systems (GIS) have been employed by many public utilities and some utility regulatory commissions. The PUCO began constructing a GIS system in the mid-1980s and still employs that system today. That system maps service territories, facility locations, transmission routes, interconnect locations, railroad crossings, and other geographically referenced data related to companies. GIS data is available on traditional paper maps, on disk or via file transfer, and on its website.[29] Other state agencies also make use of the PUCO system.

GIS applications are now moving beyond the large, legacy systems that once were required for their operation and migrating to smaller platforms and are now able to be better integrated with other systems.

The other system being created by some utility commissions, electronic filing, will be the subject of the following chapter. As was indicated, these commission systems, while improving regulatory efficiency and, in some cases, beginning to improve the management of commission information, do not have the capability to fundamentally transform the regulatory process. Transformation of the regulatory process will need to be driven by newer and, as of yet, undeveloped regulatory information systems. Four potential applications that could substantially reshape the regulatory process will be discussed in a later chapter.

The Potential for Regulatory Information Systems

One way to examine the potential for the application of electronic information systems to public utility regulation is to identify each of the nodes of communication in the regulatory environment and compare the potential for information technology to impact that node to the extent to which those technologies have been applied to the node. Figure 1.2 identifies four sets of information providers, which also are

[29] Public Utilities Commission of Ohio, "2000-2003 Information Technology Plan," 23.

information recipients in other contexts. This four-by-four matrix then creates sixteen communication nodes (e.g., node 1.B., regulators providing information to service providers or node 3.A., consumers providing information to regulators). Four of the nodes (1.A., 2.B., 3.C., and 4.D) represent regulator-to-regulator, provider-to-provider, consumer-to-consumer, and policy maker-to-policy maker communications. These nodes have relevance, too.

- Each node is assigned a potential for application of information systems (PH (high), PM (medium), and PL (low)) and a score indicating the authors' assessment of the current level of systems application (AH, AM, AL). For each node, a short description is provided of the types of information exchange that might occur. Of most interest are those nodes where the potential for systems application is high but the current state of application is medium or low. Those nodes are discussed in turn: 1.A.: Regulators-to-regulators. Though regulators have established effective formats for informal and face-to-face communications, data exchange between state jurisdictions is handicapped by a lack of standardization. Reporting formats are not standardized, data collection is not uniform, and sources of data have been largely limited to utility company statistics. Where uniformity of data exists it has been standardized at the federal level through the SEC EDGAR system, the FCC ARMIS system, the FERC filing forms, and the Energy Information Administration. Manual collection of state-level data by NARUC was terminated after the publication of the 1995-96 edition. Utilities operating in more than one jurisdiction are required to make multiple filings in different paper formats.

- 1.C., Regulators-to-consumers. Regulators have significantly improved their communications with consumers, which includes the substantial use of websites. More could be done, however, to enhance regulator-to-consumer communications. Consumers with complaints could be allowed to track the progress of those complaints electronically, much in the same way that a customer can track lost baggage or a package being sent by an express courier service. More quality-of-service data could be provided to consumers as could customer preference data (see 3.A., below). In Michigan, visitors can sign up for one or more of several listserves that will automatically e-mail notices, an example of a "push" information system that will be described later in the discussion in Chapter 4 of the creation of an electronic regulatory library.

- 1.D., Regulators-to-policy makers. In the past, regulators saw little need to communicate with legislators and other policy makers. One argument held that the independence and judicial nature of public utility commissions made interaction with legislators inappropriate. Now that legislators have assumed a more prominent role in utility policy making,

they need good information. Commission interaction with legislators, though improved dramatically, is typically ad hoc. The provision of good, well-analyzed data, particularly regional and national data that might provide early warning of problems, would serve legislators well.

- 2.A., Providers-to-regulators. As more service providers and brokers of utility service operate in multiple jurisdictions, standardized filing would be useful and feasible. Even those which operate in only one jurisdiction should have the opportunity to interact with regulators in the most cost-effective manner, which is often assumed to be electronically. The initiatives of the National Association of Insurance Commissioners (NAIC), which will be examined later, place a high premium on uniform national and electronic provider-to-regulator filing.

- 2.C., Providers-to-consumers. As utility markets become more open to competition, the utility interaction with consumers will become more important, and consumers will require good quality and price information. Customers can now begin and terminate service electronically, pay bills electronically, and inquire about account status. What is missing may be information on service and pricing options, the very information that will be required if markets are to be competitive. Real-time pricing and metering would help customers make the most effective use of their utility service expenditures. If consumers have choices, they will also ultimately desire quality-of-service information about rival providers. One scenario of provider-to-consumer communications development would be provision of enough pricing information to allow electronic shopping robots (referred to as "bots") to shop on a daily, hourly, or by-telephone-call basis to identify the best available rate. This scenario is dependent on the identification of utility service as a commodity with little or no quality variation.[30] The use of bots is discussed at greater length in Chapter 3.

- 3.A., Consumers-to-regulators. Consumers can submit complaints via e-mail to state commissions, though they cannot directly interface with the complaint handling system. A few states have surveyed consumers to identify their preferences and needs. But few regularized mechanisms exist for the collection and use of consumer preference and demographic data on a state, regional, or national basis. This type of data, which should drive policy making, could be of great use to regulators, service providers, and policy makers. Consumers are not regularly provided an opportunity to provide comments about the regulatory commission or regulatory process itself.

---

[30] For a description of the strengths and limitations of bots, see John Seely Brown and Paul Duguid, *The Social Life of Information* (Boston, MA: Harvard School Press, 2000), 41-56.

Fig.1.2: Regulatory Information Systems: Potential Versus Current Status

Information Providers

Information Recipients	Regulators 1	Providers 2	Consumers 3	Other Policy Makers 4
A. Regulators	PH Standardized Information	PH Electronic info. exchange	PH Needs, complaints, satisfaction	PL Infor. needs, intent of leg.
B. Providers	AL PH Decisions, cases	AL PH Improved OSS/EDI	AL PM Preferences, complaints	AL PM Policy action
C. Consumers	AM PH Rates, options processes	AM PH Rates, service information.	AM PM Consumer to cons. sharing	AL PM Policy action
D. Other Policy Makers	AM PH Early warning, decision sppt	AM PL Policy needs	AL PM Policy needs, preference data	AL PH Standardized Information
	AL	AL	AM	AL

P = Potential A = Current Application H = High M = Medium L = Low

Source: Author's construct

Whether or not the appropriate potential applications have been accurately identified and the state of the art accurately assessed, the lesson of this analysis is that much remains to be accomplished if regulatory agencies are to realize the full potential of electronic information systems and if they are to ensure the appropriate flow of information necessary for utility markets. Potential solutions for closing the gap between the potential of information systems and their current application will be addressed later in this report.

The Costs of Regulatory Information Systems

Unfortunately, achieving the potential benefits of regulatory information systems will come at a cost. Certainly there are the financial costs of purchasing or building systems, installing them, maintaining them, providing training in system operation to users, and providing users with the equipment necessary to operate the system. These costs can be considerable; methods of reducing costs and identifying resources for systems will be discussed in a later chapter.

In addition to these obvious, financial costs, there are other costs or risks involved in the application of regulatory information systems. They include:

- The potential for failure. According to John Thorp, the "Information Paradox," which refers to the decline in productivity despite massive investments in computers, implies that "a handful of IT project teams and their sponsors are clearly picking winners, while a few less-fortunate teams are struggling to bring some losers under control." He further states that "the majority just aren't sure how things will turn out when they deliver the new technology or information systems upgrade they are working on."[31] He also cites a Standish Group study that indicates that in 1996, 73 percent of corporate America's IT projects were late, over budget, or cancelled.[32] The result is that success in information technology implementation is far from assured. Dimensions of system complexity (and the potential for failure) are the systems linkages with organizational strategy and other initiatives, the reach of the project and areas impacted, the people affected and their competencies, and the time

[31] John Thorp and DMR's Center for Strategic Leadership, *The Information Paradox* (New York, NY: McGraw-Hill, 1998), 9.
[32] Ibid., 12.

it takes to realize the benefits of the system.[33] These risks can be reduced by not eliminated by good planning, identification of expectations, up-front identification of system specifications, and good project management.

- Increased total system costs. Too often, those who install systems fail to take into account the full system costs. Savings for one organization can result in increased costs for another. An interesting potential might be the application of electronic filing. Electronic filing could reduce costs for some utilities and the commission but could increase costs for other utilities that might need to upgrade hardware and software to comply. Similarly, electronic filing might reduce initial copying costs, where copies might have formerly been made at two cents per copy on a high-speed copier. Costs would be increased, though, if analysts persist in making copies at their desks at seven cents per copy on a desktop laser printer.[34] In addition to the printing costs, the analyst time is lost and the interruption may further diminish their productivity.

- Hidden and distributed staffing costs. Information system costs are sometimes underestimated because they do not adequately account for the costs of staff time spent coping with the system. According to Paul Strassman, most businesses lose about $5000 per year per workstation to "stealth spending." Of this amount, 22 percent is for peer support and 30 percent is for the "futz factor," which includes "the time users spend in a befuddled state while clearing up unexplained happenings and overcoming the confusion and panic when computers produce enigmatic messages that stop work."[35] Of particular concern is the commission analyst who prefers to work on information systems rather than perform assigned tasks. To some extent, that person is highly useful to the organization; on the other hand, he or she may not be making the best use of his or her training and talents. In at least one commission, the chronic shortage in information systems talent has been offset by allowing staff in other offices to develop skills in system administration and maintenance.

- Breach of security. As more commission functions are converted to electronic processing, the potential for system breakdown by "hacking" or breach of security increases. Paper systems and files are not risk free but typically are not subject to malicious destruction in the same manner that electronic systems are. As a result, disaster recovery is more critical in electronic systems than paper ones, and the probability that disaster

[33] Ibid., 23-25.
[34] Copy costs were provided by the Ohio State University's Cost Per Copy Center, which manages copier and printer leases for University departments.
[35] John Seely Brown and Paul Duguid, *The Social Life of Information* (Boston, MA: Harvard Business School Press, 2000), 77.

recovery plans will need to be implemented is higher. As a case in point, early in the implementation of the Michigan PSC's electronic filing initiative, multiple systems failed, putting the system at risk. Ultimately, no data was lost though resources needed to be directed to recreating electronic files. At any commission, machine failure, infection by virus, and inappropriate access to the system are all possible. It is important to note that there is no absolute security standard. Making electronic information systems safer than their paper counterparts may be an adequate goal.

- System obsolescence. Paper systems have existed for centuries without changes in technology that could render them unreadable. Rapid changes in information technology creates, and probably will continue to create, "stranded investment" in systems and require ongoing replacement. Investment in the wrong information technology can hasten obsolescence. Of particular concern is the investment in storage media; if storage media become obsolete, substantial costs will be incurred to restore data in a new, useable format. System obsolescence is less of a concern with web and desktop technologies, since upgrades can be done continuously with minimal user impact.[36]

- User dissatisfaction. As already indicated, systems have a fairly high probability of failing to deliver the full range of required or requested capability. In addition, it is often difficult for systems designers to identify what the real needs and expectations of users are. There is the risk, therefore, that the system will fail to deliver the levels of satisfaction anticipated. According to John Seely Brown and Paul Duguid, most systems rely on social amalgams to keep everything running.[37] As a result, information systems are also social systems that rely on human interaction and the exchange of information. Any disruption of the existing social system, even for the better, will encounter resistance.

- Failing to integrate information systems into the strategic direction of the commission. If a commission fails to integrate its information systems into its strategic direction, it will run the risk of spending scarce resources on systems that enhance unnecessary processes. At best, resources will be wasted; at worst, resources will be directed away from their highest and best use. Information systems, particularly at high levels of sophistication, are business systems first and technological systems second.

- System and vendor dependence: The downside of information system successes is that the commission can become dependent on them. An additional level of dependency can develop if the information systems are installed and maintained by vendors rather than employees. If that is the

[36] Ernest Pages, comments on review of this report.
[37] John Seely Brown and Paul Duguid, *The Social Life of Information*, 77.

case, the commission becomes dependent on a third party over which it can exercise little control. More discussion of the use of consultants is provided in Chapter 4.

These are substantial costs and risks that could deter the faint-hearted or those who are predisposed to skepticism about the benefits of electronic information systems. Fortunately, most of these costs and risks can be mitigated (but not eliminated) by careful research, planning, and implementation.

The Potential Benefits of Electronic Regulatory Information Systems

So why do it? Why invest in electronic information systems if the potential costs are so considerable? There are good reasons and bad reasons. Some of the bad reasons are:

- Because everybody else is. Clearly, many business enterprises and government agencies have made good use of electronic information systems, but not all have.
- To save paper. Ecological concerns aside, saving paper does not necessarily translate into saving money or time.
- To create the appearance of responsiveness and innovativeness. Implementation of electronic information systems should not be used as a smokescreen to generate the appearance of organizational change.
- Because it's there. There is a seductive element to information systems, a glamour associated with being at the cutting edge of the era. Personal gratification is not, however, adequate justification for the expenditure of substantial amounts of public funds.

There are, however, good reasons to explore the use of electronic information technologies. Some of the better ones are:

- To simplify and increase access to information (e.g., one-stop-shopping for consumers and allowing remote access and participation) and improve customer service. Though the demise of distance through the application of information technologies may be premature, electronic information technologies can allow access to commission activities from a distance. In addition, access can be continuous and available at the convenience of

the user. As technology takes over routine tasks, attention can be focused on delivering improved customer service and meeting special needs.[38]

- To make the regulatory process more public and transparent. By increasing access, information technologies can also allow the regulatory process to become more open, accessible, and transparent.

- To improve the quality of decision making and improve analytic capabilities. Much more will be said later in this report about knowledge management systems, which include text mining and document warehousing, as methods for increasing the amount and usefulness of information available to decision makers.

- To support the attainment of the commission's mission. Most commissions have revisited their mission and vision in the past several years; in many cases application of electronic information systems can help them in the pursuit of those new directions. This report will address information systems planning techniques, which include integration of the information systems and overall commission strategic planning.

- To improve regulatory efficiency (save time and money and ensure that staff spend them in the highest and best use). According to the NECCC, organizations are now achieving documented cost savings for the first time since computers entered the workplace due primarily to Internet technologies.[39]

- To improve satisfaction with the regulatory process. Commissions, though independent in some ways, are ultimately responsible to their stakeholders. The satisfaction of those stakeholders determines the credibility of the commission, its ability to garner resources, and the success of the regulatory regime.

- To meet legislative and executive mandates. As noted earlier, some legislators and state executives are mandating a movement toward e-government.

The Challenge of Regulatory Information Systems

Charting the right course in these endeavors will be a challenge for commissions. Chief among those challenges are:

[38] NECCC, "E-Government Strategic Planning: A White Paper," 7.
[39] NECCC, "Critical Business Issues in the Transformation to Electronic Government," 4.

- Making the business case for investment in electronic information systems. Though cost savings are possible and now more probable given Internet technologies, some of the potential benefits of information system application are improvements in stakeholder satisfaction and regulatory effectiveness. Those types of benefits are difficult to quantify. Given the importance of public utility service provision to the economic development of states and the nation, suitable and convincing proxies can possibly be found. Determining where to start and which regulatory system to apply first will be a key question (e.g., a small system with fast payoff or large system with greater potential for future impact).

- Acquiring the necessary financial resources. Unfortunately, some of the systems likely to most significantly improve the regulatory process are not inexpensive. Innovative funding and/or high level state government and stakeholder support will be required.

- Identifying the necessary expertise. State information systems staffs are generally poorly compensated relative to their peers in business. As a result, the expertise necessary to build and maintain new and sophisticated regulatory information systems may need to come from outside the commissions. Management of consultants involved in large-scale and critical information systems presents an additional challenge for commissions. A later chapter in this report will discuss the use of consultants to staff the commission information systems function and some of the problems of commission information systems staffing.

- Getting the attention of regulators. Public utility commissioners have plates that are full to overflowing. Taking the time to learn about, make decisions about, and champion information systems applications will have to nudge other items off of overcrowded commissioner agendas. In addition, some of these systems may not have short-term payoff and may, in fact, increase short-term workloads during conversion and implementation.

- Getting "buy-in" from the stakeholder community. As noted above in the discussion about identifying resources, stakeholder buy-in will be critical for funding. It will also be critical for system success. Utility stakeholders are making substantial investments in electronic technology and, as a result, may be predisposed toward e-regulatory initiatives. But those initiatives will need to mesh with utility systems and plans. Other stakeholders, who are not as able to employ electronic information technology, may believe that these initiatives pose a threat to their ability to participate in regulatory processes. Lawmakers may be off-put by the cost of systems if those systems do not generate nearly immediate financial returns.

- Implementation. Once these considerable hurdles are crossed, the tough task of system design and implementation remain. Statistics quoted earlier clearly indicate that the construction and implementation of complex electronic information systems are monumental tasks.

So will it be worth it? The commissions that have already begun to implement portions of e-regulation obviously think so. And, as information technologies transform the economy and the way that many businesses and government agencies operate, it is hard to imagine that substantial benefits will not also accrue to the important business of public utility regulation.

CHAPTER 2

ELECTRONIC REGULATORY FILING

The idea is deceptively simple: replace the mountainous paper filings by utilities to regulatory commissions with electronic files that can be easily transferred, accessed, recalled, and filed. In the process, costs will undoubtedly decrease, analysis and decisions will be improved, stakeholder access will be made more convenient, and forests will be saved.

Unfortunately, life, particularly in the fast-changing world of public utility regulation, is not that simple. That is not to say that electronic regulatory filing (ERF)[40] is not a worthwhile idea for which a valid business-case argument can be made. ERF, however, can be complicated and costly. It can be a tough sell to stakeholders, though stakeholders may also be the driving force behind ERF adoption. Despite the complications inherent in ERF, given improvements in electronic information technologies, the ubiquity of the Internet, and the potential to save money and improve decision making, ERF may eventually be a dominant feature of the regulatory landscape.

This chapter identifies some of the critical issues commissions will need to grapple with in the movement toward ERF, identifies some of the variants of ERF, examines some commission ERF applications and experiences, presents a complex business-case argument for ERF, and explores low-cost options for ERF application.

Key ERF Issues for Regulatory Commissions

Before commissions ponder the systems complexities and financial aspects of ERF, there are a number of other issues that must be resolved. Those issues, which are discussed in turn in the following sections, include the legal framework for ERF, security, the "document culture," and several related issues.

[40] ERF is used as an abbreviation throughout this report rather than ELF (electronic filing) in deference to the National Energy Board of Canada, one of the pioneers in the field, which uses ERF to describe its systems.

The Legal Framework for ERF

Regulatory commissions operate within a quasi-judicial environment, and, unless overturned by courts, their orders and requirements have the force of law. In that environment, documents filed with the commission must have legal standing if the legal requirements of the commission are to be met.

Not surprisingly, until recently the preponderance of the legal framework undergirding commission operations was based on the assumption of paper copies. That assumption may have been derived from a statute of frauds influencing the enforceability of agreements or from record retention statutes.[41] The paper assumption and the resulting legal framework that empowers it are not unique to public utility regulation but are clearly out of step with ERF and electronic data interchange in general.

Fortunately, the barriers created by the assumption of paper filing and paper record retention are being dismantled. The National Conference of Commissioners on Uniform State Laws (NCCUSL)[42] has examined the requirements for electronic commerce with an eye toward establishing the equivalence of an electronic record of information and electronic signatures without affecting the underlying legal rules and requirements.[43] The outcome of the NCCUSL study of electronic transactions was the creation of the Uniform Electronic Transaction Act (UETA), which was approved by the NCCUSL and recommended for enactment in all the states. As of April 2001, UETA had been adopted by 25 states and introduced in 18 others, the District of Columbia, and the Virgin Islands. For a listing of states that have adopted or introduced UETA, see Tables 2.1 and 2.2.

---

[41] National Conference of Commissioners on Uniform State Laws, "Uniform Electronic Transactions Act with Draft Prefatory Note and Comments," December 1999, i.

[42] The NCCUSL is a not-for-profit association comprised of state commissions on uniform laws from each state. The more than 300 commissioners are appointed by the states and must be members of the bar. The NCCUSL has one purpose: to study and review the law of the states to determine which areas of law should be uniform. The commissioners promote uniformity by drafting and proposing specific statutes in areas where uniformity is desirable.

[43] National Conference of Commissioners on Uniform State Laws, "Uniform Electronic Transactions Act with Draft Prefatory Note and Comments," i.

Table 2.1

UETA State Adoption

as of April 3, 2001

Arizona	Iowa	North Carolina
Arkansas	Kansas	Ohio
California	Kentucky	Oklahoma
Delaware	Maine	Pennsylvania
Florida	Maryland	Rhode Island
Hawaii	Michigan	South Dakota
Idaho	Minnesota	Utah
Indiana	Nebraska	Virginia
		Wyoming

Source: NCCUSL at NCCUSL.org

Table 2.2

UETA State Introduction

as of April 3, 2001

Alabama	Montana	Tennessee
Connecticut	Nevada	Texas
District of Columbia	New Hampshire	Virgin Islands
Illinois	New Jersey	Vermont
Massachusetts	New Mexico	West Virginia
Mississippi	North Dakota	Wisconsin
Missouri	Oregon	

Source: NCCUSL at NCCUSL.org.

UETA addresses legal recognition of electronic records, electronic signatures, and electronic contracts; retention of electronic records; time and place of sending and receipt; admissibility into evidence; creation and retention of electronic records and conversion of written records by government agencies; and acceptance and distribution of electronic records by governmental agencies.

The U.S. Federal Government has adopted the Electronic Signatures in Global and National Commerce Act, S. 761 (E-SIGN), with an effective date of October 1, 2000. E-SIGN states that a signature, contract, or record in interstate commerce shall not be denied validity because it is in electronic form and makes specific reference to UETA.[44]

The adoption of UETA, or a state or federal equivalent, is not required for ERF though it would make ERF more useful. At least one state (Alaska) has initiated an ERF system discussed below that does not rely on an official electronic copy but employs ERF after the submission of a paper filing for dissemination and analysis of filed information.

The NCCUSL has also approved and recommended for state enactment the Uniform Computer Information and Transactions Act (UCITA). As of April 2001, UCITA has been adopted by Maryland and Virginia and introduced in Arizona, Illinois, Maine, New Jersey, and Texas. UCITA is more far-reaching than UETA and recognizes a fundamental shift in commerce from manufacturing to the exchange of information. UCITA, which is also more controversial than UETA, is designed to deal specifically with information exchange and emphasizes the terms of licenses that define product usage. It "provides a coherent contract law framework for analyzing a lease, which has been the dominant contractual framework for commerce in computer information."[45]

In addition to ensuring that electronic authorizations, contracts, and signatures have the same legal effect as those done on paper, the legal framework for e-government readiness (and public utility ERF) should:[46]

---

[44] UETAonline.com, "What Happened to UETA in Congress," April 3, 2001.
[45] NCCUSL, "Uniform Computer Information Transaction Act with Prefatory Note and Comments," 6-7.
[46] National Electronic Commerce Coordinating Council, "Critical Business Issues in the Transformation to Electronic Government," December 2000, 8.

- Preserve basic public policy goals, such as privacy and security, retention, and public access to information.
- Provide the statutory basis of, authority for, and regulations related to the process of government.
- Assign responsibility for and ownership rights to the data provided.
- Address the sharing of data collected by one government agency with other agencies that need the same information.
- Clearly define jurisdictional responsibilities.
- Provide a mechanism by which legal requirements are recognized and enforced.
- Provide a basis for establishing fees related to electronic processes and services.
- Not be technology specific or favor one form of service delivery (traditional or electronic)
- Minimize costs and the potential for litigation.

ERF Security

Given the well-publicized activities of computer "hackers," the dissemination of computer "viruses," the newness of the technology, the sensitivity and critical nature of the information exchanged in ERF systems, and the public's general distrust of technology, security of ERF systems is a major issue. Indeed, computer system failure can be regarded as a certainty, and the price of protection from that failure is constant vigilance and redundancy.[47] For ERF purposes, security can be defined as protection from intended and unintended breaches that would result in the loss or dissemination of data or compromise of the regulatory process.[48]

[47] Edward Tenner, *Why Things Bite Back: Technology and the Revenge of Unintended Consequences* (New York, NY: Vintage Books, 1996), 242-243.
[48] Adapted from NECCC, "Critical Business Issues in the Transformation to Electronic Government," 12.

To that end, ERF systems need to address:[49]

- Data confidentiality–to keep information private
- Data integrity–to prove that the information has not been manipulated and that the document sent is identical to the one received
- Authentication–to prove the identity of an individual or application
- Non-repudiation–to ensure that information cannot be credibly disowned

Electronic systems meet these objectives largely through cryptography. Cryptography in connection with electronic commerce usually refers to the process of scrambling plaintext into ciphertext (through encryption) and back again. It also includes the regulation of human behavior (e.g., encouraging the selection of hard-to-guess passwords, logging off unused systems, and not discussing sensitive procedures with outsiders). An important enabler of ERF is the issuance of digital certificates, which establish electronic credentials for doing business. Digital certificates authenticate the identity of the holder and protect data exchanged online from theft or tampering. These certificates are issued by certificate authorities and contain the name of the holder, a serial number, expiration dates, a copy of the holder's public key (for encryption and digital signature), and the digital signature of the certificate granting authority so that recipients can verify that the certificate is real.[50]

The National Energy Board (NEB), which is creating what is arguably the most sophisticated ERF system in the hemisphere, is in the process of installing a Public Key Infrastructure (PKI) for its ERF system. The PKI is a combination of software, encryption technologies, and services. Specifically, the PKI will employ digital certificates, public key cryptography (a matching pair of encryption and decryption keys each of which performs a one-way transformation of data that can only be reversed by its matching key), and certificate authorities (described by the NEB as the digital world's equivalent of passport offices). According to the NEB,

[49] National Energy Board, "The ERF Connection: The Electronic Regulatory Filing Newsletter," No.3, Winter 2001, 3.
[50] The definitions and explanations in this paragraph were drawn from Whatls.com, which provides an extensive array of computer-related definitions and essays.

although the technological aspects of PKI are important, successful PKI implementation depends more on policies and procedures, an understanding of business processes and relationships, prevailing management practices, and the overall security context.[51]

Because of rapid changes in information technologies, security systems for ERF systems must be constantly reviewed and revised. One should note, however, that no system, including traditional paper systems, can be provided with an absolutely guarantee of security. Paper systems are particularly prone to fire, flood, and deterioration over time. Electronic systems can be backed up and, if adequate system redundancy is installed, can be more secure in this regard over time than paper systems. (Identifying the appropriate long-term storage medium for ERF files will be discussed later in this chapter.)

The Document Culture

As will be demonstrated later in this chapter, generating business value from ERF requires more than the conversion of paper filings to electronic files on the assumption that the costs of paper exceed the costs of electronic files. Generating real savings and increasing regulatory effectiveness through the use of ERF will require "downstream" savings in areas like file retention and changes in the way that people use information.

As indicated earlier, if ERF merely moves printing from high-speed copiers at the utilities to laser printers in the offices of commission analysts, costs will increase. Unfortunately, many will be tempted to make that printing shift. Some theorize that an increase in the consumption of paper by U.S. businesses, despite the proliferation of electronic communications, is directly related to the ease of use, accessibility, and high quality of those laser printers. User training and other measures may be necessary to fight that natural trend. For example, General Electric has "declared war" on any machine that spits out paper but is not shared by

[51] National Energy Board, "The ERF Connection: The Electronic Regulatory Filing Newsletter," No.3, Winter 2001, 3.

multiple users. By the time the project is completed next year, GE expects to eliminate 30,000 machines. To date, paper consumption is down by 28 percent.[52]

To generate real benefits from ERF systems, designers will need to combat the document culture of commissions and stakeholders, a culture that emphasizes the "weight of the evidence." A visit to the office of most commission or utility analysts confirms the fact that paper is the standard information exchange medium. Paper is portable, conveniently sized, and easy to read. It can be marked up and shared. It creates the appearance of retrievability (i.e., many people print documents so that they can be stored and used later; unfortunately, the reliability of individual filing systems is suspect.). Paper is central to the exchange of information across the formal and informal communities of information that characterize public utility regulation. Because of its advantages, the use of paper as an information medium will not disappear with the installation of ERF systems, and the paperless regulatory office will not eventuate. According to Edward Tenner, paper seems to have an existence of its own that defies the human will to control it.[53]

To prevent ERF systems from merely shifting costs from utilities to commissions, analysts and others will need to change the way they use electronic and paper information, and ERF administrators will need to devise ways to change behaviors as well as build systems. As an example, in order to encourage its staff to use electronic documents online in lieu of printing them, the Illinois Commerce Commission is buying bigger computer monitors, and IS staff is doing file conversions for Commission staff. To encourage staff to avoid traveling with paper, it is exploring the use of personal data assistants (PDAs) for use as "e-books."[54]

---

[52] Pamela L. Moore, "GE Embraces the Paperless Office," *Business Week*, June 25, 2001, 10.
[53] Edward Tenner, *When Things Bite Back: Technology and the Revenge of Unintended Consequences*, x.
[54] Conversation with Michael E. Porter, Chief Information Officer of the Illinois Commerce Commission, Springfield, Illinois, April 10, 2001.

Other ERF Issues

There are a number of other issues that commissions adopting ERF will need to deal with, issues that do not merit the extent of discussion provided the prior three issues. Those additional issues are:[55]

1. Filing formats. The commission must specify the filing formats it can accept for electronic filing. This is one of the most important issues that a designer of ERF must resolve. Much more will be said about filing formats and their implications later in this chapter.

2. Citation. Because word processing applications do not maintain line and page integrity when different users open and print the same document, page number citations are sometimes inconsistent. One solution is to require paragraph numbering in filed documents.

3. Record retention. Commissions are required to retain copies of filed documents in a format that satisfies legal requirements and renders the document retrievable for the duration of the required retention period. Of particular concern is the potential obsolescence of software and hardware (i.e., documents filed on 5 and 1/4 inch diskettes would now be impossible to read unless outdated equipment was maintained for that purpose.). Considerable savings can result from electronic storage in lieu of paper records.

4. Official filing date. Because the Internet is always available, filings can be made at any time. Cut-off times will need to be specified. In addition, in the case of long documents, a period of time can elapse between the first and last transmitted byte. Commissions will need to determine whether first or last byte transmission will be regarded as official receipt. Some documents may be received in a corrupted manner, or documents may be received that trigger virus warnings. Outright rejection of these kinds of documents might discourage utilities from participating in ERF systems. Of additional concern will be the inability of filings to be received because of computer problems at the commission that might prevent document receipt.

5. Electronic filing authentication and validation. This issue was partly addressed above in the discussion of security. Of particular concern is the format of and acceptability of electronic signatures on filed documents.

[55] These issues and some of the narrative descriptions were drawn from Federal Energy Regulatory Commission, "Notice of Availability of Staff Issue Papers for Technical Conference," June 15, 1999, 2.

6. Document content standards. Some document formats have the ability to contain complex embedded objects and functions such as hyperlinks to external references, auto-date entries, or embedded macros. Decisions about the acceptability of those document contents will need to be made.

7. Document size. There may be limits on the commission's ability to handle multiple documents and documents of large size especially in initial ERF trials.

ERF Models: State Systems

ERF is not monolithic; the choice to adopt is not, by any means, a simple either-or transaction. ERF models vary by complexity, cost and functionality. As indicated earlier, one of the principal variables that distinguish ERF systems is the filing format–the types of files required or allowed by the commission ERF system. Figure 2.1 illustrates some of the options available to states in increasing order of cost, complexity, and functionality. It also identifies state or federal regulatory commissions whose ERF systems adhere to each model. The remainder of this section discusses those systems and choices and some of the pros and cons of the options they have chosen. This section does not attempt to describe the ERF efforts in every state but only discusses those that provide useful examples for analysis.

Paper Filing and Electronic Conversion–Alaska

The Regulatory Commission of Alaska (RCA) is in the midst of the first step of installation of an ERF system. Because the RCA requires traditional signatures on filings, their system converts filed paper into electronic files through the use of high-speed scanners. Scanned documents are converted to Tag Image File Format (TIFF), one of the most common formats for exchanging images between application programs. Filers are encouraged to submit their documents both on paper and electronically.

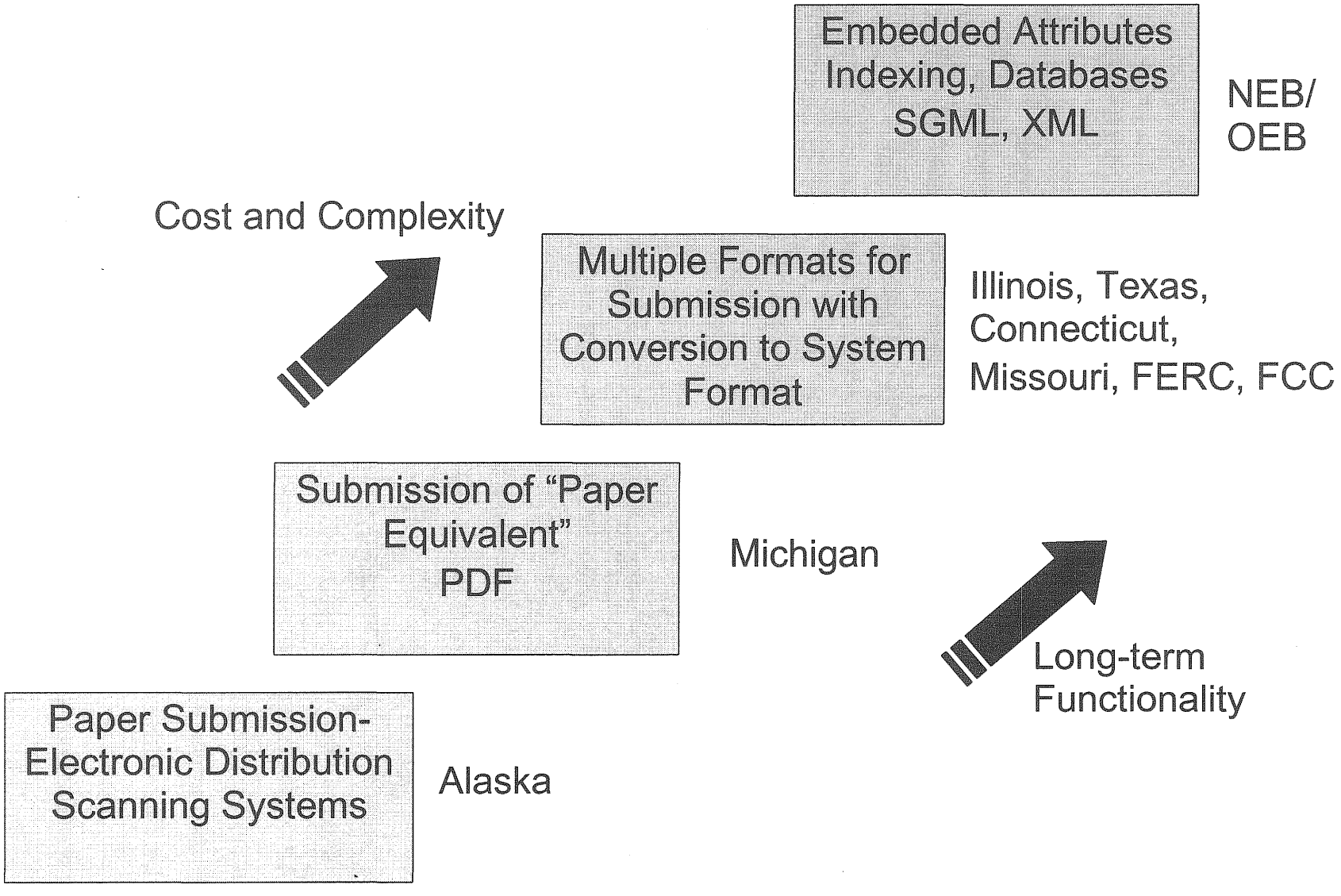

Figure 2.1: Electronic Filing Variants and Tradeoffs

Source: Author's construct

After scanning (or if received electronically), documents are then routed electronically to appropriate parties. Because of the electronic conversion and routing, the number of hard copies required to be submitted has been decreased. With the documents in electronic format, analysts can add "sticky notes" and comments and attach other documents to the image. Documents already in an electronic format can be imported into the system.

Documents are also able to be accessed via the Internet. Internet documents are in PDF, which will be discussed in the following section.

This system has the advantage of requiring less stakeholder buy-in to electronic filing since paper filing is still the default mechanism. It maintains better control of filed document format than some systems discussed later. It also relies on the economies achieved through the filing of fewer copies, better document accessibility in post-filing stages, and improved analysis due to electronic availability and manipulation of files.

Submission of Paper Equivalents (PDF)–Michigan

The Michigan Public Service Commission (MPSC) began an electronic filing pilot project in late March of 1999. Voluntary electronic filing under the pilot test began that same calendar year. In order to create a simple, straightforward system with easy implementation and fast results, the MPSC elected to require submission of documents in portable document format (PDF), a tool for universal document exchange. PDF converts various file formats, and PDF documents preserve the exact look and content of the originals complete with fonts and graphics; can contain text, tables, and graphics in one document; supports digital signatures; and cannot contain viruses. PDF documents maintain pagination, which may not be the case with word processing formats, which can be influenced by the particular printer driver in use. PDF files are the electronic equivalent of a portable photograph of the document, but PDF documents are limited in their ability to be manipulated. PDF documents are created using software available from Adobe Software; they can be viewed and printed using Adobe's Acrobat Reader, which is free and easily

downloaded, though conversion of documents into PDF requires the purchase of software from Adobe.

The MPSC ERF system is being phased into existence. In 2000, eight percent of cases were electronically filed. The target for 2001 is 33 percent; for 2002, 66 percent; and for 2003, 100 percent. Michigan law, effective in October, 2000, allows electronic records and signatures to suffice in those cases where written records and signatures were required. Positive feedback has been received from users.[56]

According to the MPSC, PDF was selected because of its portability, visual integrity, wide and prevalent use, immunity from viruses, legal concerns, a low learning curve, and low training costs. By requiring filers to use PDF, the MPSC eliminated the need to subject filed documents to quality tests, which would have been necessary to ensure that the document converted from the filer's format properly reflected the content of the original document submitted. Filers using the MPSC ERF system retain the responsibility to present documents to the MPSC as they would have those documents be, rather than to have MPSC staff manipulate and convert those documents.[57] The speed with which the MPSC staff created their ERF system and began the acceptance of documents is a testament to the simplicity and ease of use of PDF-based ERF systems as well as the hard work and expertise of MPSC staff.

The selection of PDF as a filing standard is further buttressed by the action of the federal judiciary, which is using PDF for its Case Management/Electronic Case Files system. The designers of that system point to the ability of PDF to deliver documents that are exact replicas of the originals, an important design point for judges and attorneys.

---

[56] Michigan Public Service Commission, "Pilot Program Evaluation: Electronic Case Filings," February 2001.
[57] Ibid., 38.

Multiple Submission Formats–Illinois, Texas, Connecticut, Missouri, FERC, and FCC

A number of regulatory commissions have elected to allow filers to use one of a number of filing formats. The commissions then convert those documents to the format employed by the ERF system.

The Illinois Commerce Commission (ICC) initiated its web-based electronic filing and docket system in January 2000. Filings can be made in either electronic or paper form. In the future, the ICC may implement additional incentives to further encourage electronic filing. The ICC system uses a vendor's proprietary software that reads multiple formats but converts files to PDF. This puts all docket material in the same format and facilitates web-based retrieval.[58]

The ICC is also proposing an Electronic Government Initiative consisting of five inter-related projects. They are:[59]

1. Electronic Filing System: An expansion of e-Docket that would allow electronic tariff filing much in the same manner as the ERF system allows case filings

2. Electronic Document Management: A web-enabled system that would serve as an agency-wide document repository for electronic and scanned documents

3. Electronic Records Management: An extension of the e-Docket system that facilitates the transition from paper-based to electronic documents by providing a mechanism and resources for conversion of existing documents

4. Electronic Workflow: Workflow software that will focus on defining and assessing key work processes, re-engineering them, and automating them

5. Electronic Forms Processing: Addresses the automation of most, if not all, of the manual forms-based processes within the ICC.

The ICC knowledge-management initiative will be discussed later in this report.

---

[58] Ibid., 27.
[59] Illinois Commerce Commission, "New IT Initiative Worksheet: Draft Work Papers," November 3, 2000.

The Connecticut Department of Utility Control (DUC) has adopted an electronic filing system for contested cases. That system requires that all filings be submitted in electronic format and on paper. The current system is a non-Internet dial-up system though changes are being made to move the system to an Internet-based system. The DUC prefers filings in Word 97 or Excel 97 (for spreadsheets). Earlier versions of those softwares and WordPerfect and ASCII are accepted. The paper filing still constitutes the formal record.[60]

The Texas Public Utility Commission (PUC) ERF system also requires paper filing with optional electronic filing. The PUC system operates on a Commission interchange system employing a Windows application software available free of charge from the PUC. The interchange provides two web-based services–filings submission and filings retrieval. It accepts a number of common word processing, graphics, and spreadsheet formats and common Internet document and transfer formats.[61] Electronic documents that have been filed with the PUC are downloadable for 20 cents per page.[62]

The Federal Communications Commission (FCC) ERF system is multi-dimensional and contains on-line consumer complaints, electronic comment filing, electronic document management, and electronic tariff filing. Local exchange carriers can file tariffs, comments, documents, and petitions over the Internet. Search capabilities are also available. The FCC supports a limited number of filing formats including WordPerfect, Word, Lotus, Excel, and ASCII.[63] Files are converted to PDF.[64]

The Federal Energy Regulatory Commission (FERC) has allowed electronic filings for gas pipeline tariffs, gas pipeline rate and certificate applications, gas pipeline forms and reports, and FERC Form No. 1 reports. It now is permitting voluntary electronic filing of limited categories of documents in proceedings. Electronic filing over the Internet began in November 2000. Internet filing allows

---

[60] Michigan Public Service Commission, "Pilot Program Evaluation: Electronic Case Filings," 26.
[61] Ibid., 27-28.
[62] www.puc.state.tx.us/interchange/index.cfm.
[63] ASCII (American Standard Code for Information Exchange) is the most common format for text files in computers and on the Internet. It was developed by the American National Standards Institute. Source: www.whatis.com.
[64] Michigan Public Service Commission, "Pilot Program Evaluation: Electronic Case Filings," 24-25.

comments on applications, conferences, environmental documents, notices of inquiry, and notices of proposed rulemakings, protests, and interventions. A limited number of filing formats are allowed including Word, WordPerfect, PDF, RTF,[65] and ASCII.[66] Electronic filings can be accessed via the web in the FERC's Records and Information Management System (RIMS); FERC orders, notices, rulemakings, and other information can be accessed via the Commission Issuance Posting System (CIPS); and docket information can be accessed via the Docket Sheets and Service List (DSSL) system.

Allowing a number of filing formats has the advantage of making filing easier for stakeholders. Its disadvantages are the complexity of the conversion to a common format once received and the converse of the advantages of PDF (e.g., the potential for the introduction of viruses, greater system complexity, concern that the filed document will be changed in a meaningful way in its conversion to the system format, and the potential for pagination changes).

SGML/XML–National Energy Board

As decision makers at these commissions and in other government agencies have wrestled with the issue of the most effective way to transfer information electronically, they have considered issues of cost, complexity, ease of use, and ability to create rapid benefits. Analysis of these variables led them to system design choices.

Though these systems meet certain regulatory needs, some experts and some early collaborative government projects have concluded that a next generation of information transfer protocol is on the horizon. This next generation of information sharing will be based, it is argued, on Extensible Markup Language (XML). So convinced is it of the potential benefits of XML, the National Electronic Commerce Coordinating Council, an alliance of state and national government associations, has

[65] RTF (Rich Text Format) is a file format that lets you exchange text files between different word processors and operating systems. Source: www.whatis.com.
[66] Federal Energy Regulatory Commission, "Electronic Filing of Interventions, Comments, and Protests, v2.1, User Guide," March 21, 2001, 3-4.

issued "a call to all government decision makers to include XML in their planning efforts to create a seamless government."[67]

XML is an open-standards-based technology adopted by the World Wide Web Consortium to enhance the basic language of the web for interchanging and processing data. It is a simplified version of Standard Generalized Markup Language (SGML). It has the advantages of being able to "tag" or label elements within documents and data sets so that they can be used across systems. Those customized tags along with rules that identify how the tags relate to one another, which can be attached to the XML document or maintained in a specific location, such as an identified web server, are called Document Type Definitions (DTDs).[68] Two analogies are apt:(1) DTDs provide a blueprint that defines a document's structure, and (2) through the DTDs, XML creates a vocabulary that lists terms to be used in communications and the relationships between and among those terms.

DTDs can be standardized across an industry or across a public interest community to allow document sharing and information extraction. For example, the HR-XML Consortium, a national organization seeking an e-commerce framework for human resources, is developing HR-XML, a version of XML with DTDs addressing common human resource elements. A similar organization, Legal XML, is developing shared XML standards for sharing information across the worldwide justice community.[69] XBRL (Extensible Business Reporting Language) is an XML standard for financial information, reporting, and analysis. Other industries that have come together to develop common information sharing standards are banking, healthcare, education, energy, and publishing.[70] U.S. Government agencies employing SGML/XML for electronic information exchange include the Internal Revenue Service, the Department of Energy Office of Scientific and Technical

---

[67] NECCC, "An Introduction to XML's Potential Use Within Government," December 2000, 4. A description of the NECCC is provided in an early footnote to Chapter 1.
[68] DTDs are sometimes referred to as Document Type Declarations rather than Document Type Definitions. In order to address some of the current limitations of DTDs, The Worldwide Web Consortium has developed a recommendation for an extension of DTDs called schemas. These schemas provide a means to define the constraints on the structure and contents of an XML document. The recommendation is likely to be accepted in the near future, making schemas an integral part of XML capabilities.
[69] NECCC, "An Introduction to XML's Potential Use Within Government," 8-9.
[70] Ibid., 11.

Information, the Library of Congress–Encoded Archival Description, and the Securities and Exchange Commission EDGAR database.[71] An XML consortium is attempting to standardize election data through the creation of an XML variant called Election Markup Language (EML), and the United Nations has teamed with a U.S. company to create the Electronic Business Extensible Markup Language Standard (ebXML) as a worldwide standard for electronic commerce.

The NECCC states that "the time has come for governmental entities and their related IT associations to aggressively pursue enterprise-wide XML DTDs for information exchange."[72] Potential benefits include:[73]

1. Provision for self-described transactions
2. Enhanced workflow and document management
3. Interface with legacy systems
4. Creation of semantic web applications (i.e., applications that derive meaning from documents by linking objects, events, and concepts, and mapping the relationships among them)[74]
5. Ease of implementation
6. Acceptance across an industry

The final chapter of this report suggests that NARUC establish and lead an effort to explore the benefits of electronic filing and, specifically, create a regulatory XML in order facilitate national regulatory data exchange and analysis.

The National Energy Board of Canada (NEB) and the Ontario Energy Board have created an ERF system based on XML. Planning began in 1993, and in April 2001 the NEB began a new, phased-in, electronic regulatory system. The decision to create the information repository for the system in SGML was expected to provide

---

[71] Robin Nunn for the Ontario Energy Board and the National Energy Board, "ERF/SDE: Issues and Comment," January 15, 1999, 28.
[72] NECCC, "An Introduction to XML's Potential Use Within Government," 9.
[73] Ibid., 10.
[74] Dan Sullivan, *Document Warehousing and Text Mining* (New York, NY: John Wiley and Sons, Inc., 2001), 37.

efficient document exchange and management and to allow information to be more complete and easier to find and use. Those Boards state:[75]

> There is no perfect document format. Nor is there a perfect way to search for information in a large repository. The Boards chose a format that permits contextual information to be encoded in the document itself. Such extra information, beyond the actual words in the document, can be used to search for documents, convert between formats or do other processing based on the extra intelligence encoded in the document. SGML permits individual documents to be used like databases, not merely stored.
>
> The NEB/OEB ERF system employs five steps:[76]
>
> 1. Document definition. Specific documents from all filing organizations are made structurally generic using the ERF DTD's generic structure, which is now in version 1.5.
>
> 2. Creation of documents. New ERF documents are tagged using an authoring tool or online form. A formatting guide defines the appearance of the document.
>
> 3. Submission of documents. New ERF documents are submitted using an application called "Submit Assist." Documents are validated to meet standards, signed, and encrypted.
>
> 4. Document management and screening. Documents are stored and managed in the Board's document repository. Automated notification informs users that documents have been accepted.
>
> 5. Document access. ERF documents can be searched and accessed using a standard Internet browser.

Though the ultimate functionality of XML-based systems has the potential to be higher than other ERF systems, creation of SGML/XML-based ERFs is, obviously, more complicated and potentially more costly than other systems. From a technical perspective, XML is clearly the best option for ERF; from an administrative standpoint, simpler systems may be better. Because of the cultural and behavioral changes associated with major information systems applications, it can be argued that the best systems mimic the appearance of legal documents and paper systems

---

[75] Ibid., 10.

[76] Margaret Harper and Charles Mathis, "Electronic Regulatory Filing," a presentation to the meeting of the Canadian Association of Members of Public Utility Tribunals, Toronto, Canada, June, 20, 2001.

are designed to meet the needs of even unsophisticated users, minimize document conversion and the potential for inserting errors, and create simple document archival with the potential for conversion to the next technology.[77]

Full-scale Electronic Commerce–The Federal Communications Commission

The Federal Communications Commission's (FCC) ERF system was discussed in an earlier section of this chapter. As indicated by Figure 2.1, the FCC's ERF system accepts documents in a number of formats, as do FERC and the Illinois, Texas, Missouri, and Connecticut systems. One other aspect of the FCC system is worthy of further discussion here.

The FCC, more than any other regulatory commission examined, has created a full-function electronic interface with stakeholders. Among the functions that can be performed electronically are:

1. Extensive data retrieval. The FCC Automated Reporting Management Information System (ARMIS) is an on-line resource containing financial, operational, service quality, and network architecture data provided by the largest incumbent telecommunications carriers.

2. Licensing. The FCC allows on-line filing of applications for licenses for a variety of communications functions, including Antenna Structure Registration, Broadband Licensing, Call Sign Reservation, Equipment Authorization, License Renewal for Wireless Service, and International Bureau Licensing.

3. Consumer Complaints.

4. Access to documents. Documents are provided in three formats: full record, condensed record, and Citator, which displays citations to the record.

5. Fee payment. The FCC's Remittance Over Secure Internet (ROSIE) system allows for the payment of license application fees electronically via credit card. The system is accessed through the FCC's on-line licensing systems. This system is supplemented by the FCC's Commission Registration System (CORES) that assigns a unique 10-digit registration number (FRN) to entities filing applications or paying fees. Ultimately, the

[77] Jeff Pillon of the Michigan PSC, and Ernest Pages, comments on draft report.

FRN will be used by all Commission systems that handle financial, authorization of service, and enforcement activities.

Creating the Business Case for ERF

Those who are building and implementing the ERF systems described thus far in this chapter have built a justification for those systems and worked through the process of procuring resources for them. Those regulatory agencies that may intend to add ERF systems to the regulatory regime will need to create similar business-case justifications for them. It is unlikely that the simple, unsupported claim that costs will be reduced has carried the day to date; it is also unlikely to be successful in the future.

Figure 2.2 presents the simple, reduced cost business case argument. It employs the Results Chain, a technique that enables the preparation of road maps that support system understanding and management of complexity developed by the DMR group.[78] That ERF case links ERF creation (the initiative) with reduced total system cost (the outcome). The shortcoming of that system model is the assumptions that must be made to make that simple argument. Those assumptions are:

1. Minimized system development costs. Similarly, a cost-benefit model is highly dependent on the costs of system creation and installation.

2. A rapid enough return on investment. Investment in ERF systems may be front-loaded relative to the realization of benefits. The time-value of money asserts that future benefits must be discounted relative to immediate costs. If benefit realization is too far in the future, even if those benefits are ultimately realized, the financial case for ERF investment can be ruined.

3. Costs not pushed upstream. Pushing filing costs from the commission to others reduces the efficacy of the cost-savings argument. Reduced total system costs should be the measure of system-wide cost savings.

[78] John Thorp and DMR's Center for Strategic Leadership, *The Information Paradox: Realizing the Business Benefits of Information Technology* (Toronto, Canada; McGraw-Hill Ryerson Limited, 1998), 48.

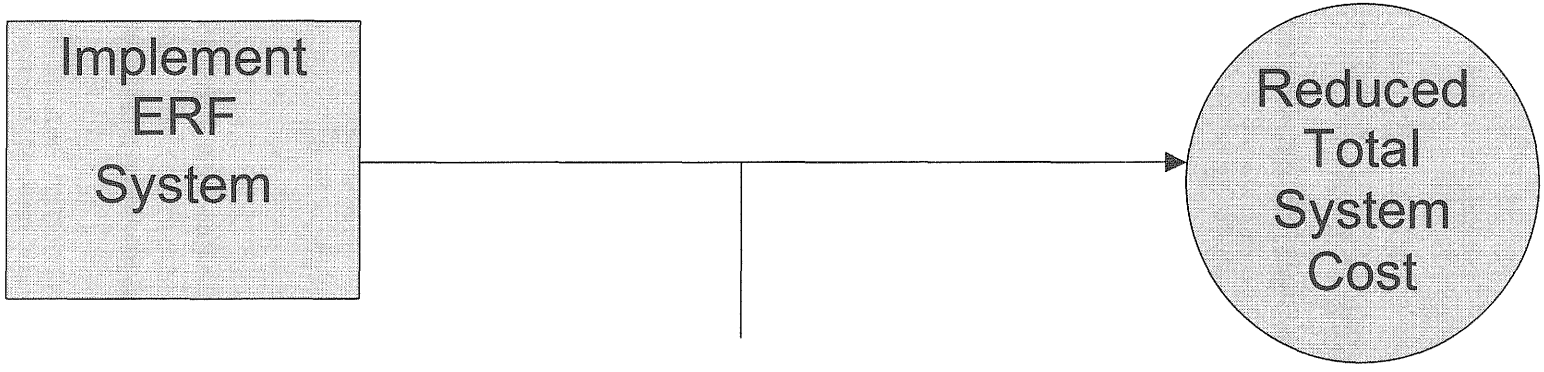

Figure 2.2: Results Chain for Electronic Filing: The Simple Case

Source: Author's construct

4. Reduced storage costs and staffing costs. For a cost-saving argument to be effective, major cost elements must be impacted. Commission information storage and retrieval costs are significant. If paper files will still be the norm after ERF installation, cost savings will be reduced. Similarly, staffing is the major regulatory cost driver; for a cost-savings argument to be effective, staff costs (internal and external to commissions) must be reduced.

5. Minimized dual-operation time. For cost savings to be realized, dual system operation, which may be required during any conversion, will need to be minimized. Because most ERF systems in use or development are being phased in slowly or are not mandatory for filers, dual systems may be with us for an extended period of time.

As a result, a pure, cost-savings argument for ERF may be difficult to maintain. There is a possibility that ERF may be more expensive than paper systems and that benefits may take some time to realize. So if costs alone cannot justify ERF installation, what can? Are there other, non-financial benefits to be realized from ERF? Some of the regulatory agencies discussed early have identified a few.

The ICC cites significant improvement of agency efficiency and positive impacts on citizens through improved availability of documents, more time for staff to focus on content as opposed to processing of documents, and increased access to government services provided by the Commission.[79] The MPSC Electronic Case Filings Pilot program was designed to explore how ERF could provide a more efficient document flow and better availability of documents for the Commission, case participants, and the public.[80] And the NEB cites the intention of its ERF to improve regulatory processes, to include participation from remote locations, the possibility of the use of software to enable groups to work together, more complete and easier to use information, and efficient document exchange and management.[81] Based on wider goals for ERF systems than simply saving paper or reducing filing costs, Figure 2.3 illustrates a more complex version of an ERF benefits chain, again based on the DMR Results Chain. This model identifies three ultimate outcomes,

[79] Illinois Commerce Commission, "New IT Initiative Worksheet: Draft Work Papers," April 2001, 4.
[80] Michigan Public Service Commission, "Pilot Program Evaluation: Electronic Case Filings," 1.
[81] Robin Nunn for the Ontario Energy Board and the National Energy Board, "ERF/SDE: Issues and Comments," 3.

the first based on efficiency and the second and third based on effectiveness of the regulatory process. They are (1) reduced total system cost, (2) improved regulatory effectiveness, and (3) improved user satisfaction, which includes enhanced access to the regulatory process by stakeholders. In order to achieve those outcomes, seven sub-outcomes are required. They are: reduced record storage cost, reduced installation cost, reduced off-line printing, faster data availability, better trained users, more public access to information, and improved communication among users.

Because of the expanded set of potential outcomes, initiatives in this more complex model expand from the single implementation initiative employed in the simple model to seven initiatives that lead to the three outcomes. Those seven initiatives are:

1. Initiation of the program. This includes creating the business case for ERF, enlisting support from key stakeholders, acquiring resources, systems planning, and technical design of the ERF system.

2. Creation of a record storage plan. As indicated earlier, reduced storage costs are a significant driver in the attempt to save money through ERF. An ERF system should impact how records are stored and retrieved both as a way to reduce costs and make data more available.

3. Establishment of the legal framework to enable ERF. ERF application will raise a number of legal questions, including electronic signatures, the legality of electronic files, filing dates, authentication, and storage requirements.

4. Identification of the electronic format for input. System design is part of the first initiative listed, but because of the importance of the input format, is separately considered here. As indicated by the examination of regulatory commission ERF initiatives, the choice of the format for filing is the single most important ERF decision a commission will need to make. Will utilities and intervenors be required to submit documents in paper, PDF, designated word processing programs, any format, or SGML/XML?

5. Training of analysts in system use. Effective information system installation takes into account the fact that information systems have important cultural aspects. Those who will use the system will be asked to change their behaviors with regard to information retrieval, analysis, and storage. Without extensive training (and buy-in) by users, the ERF system is likely to fail to reach all three intended outcomes.

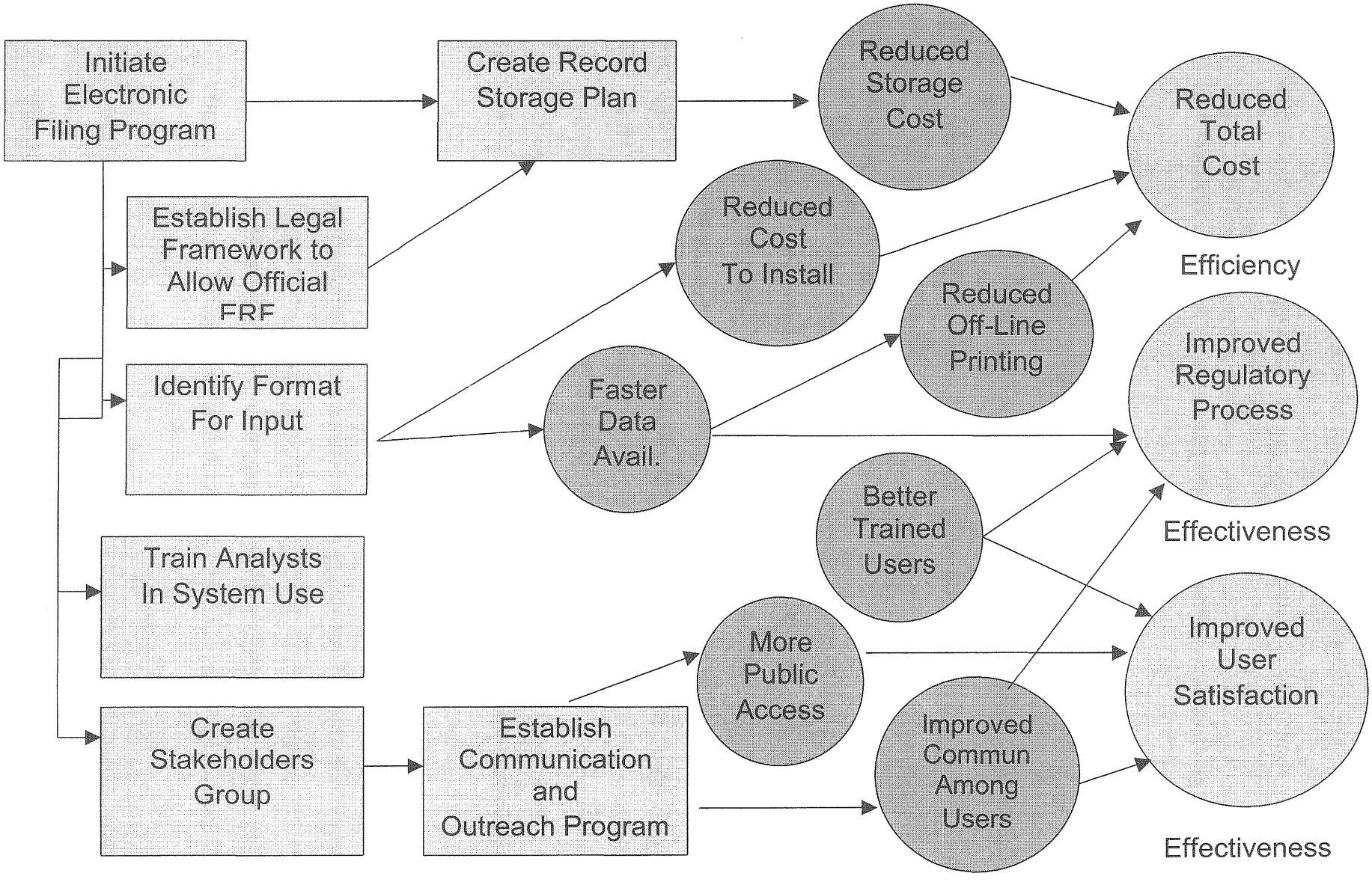

Figure 2.3: Complex Results Chain for Electronic Filing

Source: Author's construct

6. Creation of a stakeholders advisory group. External buy-in is critical. Because commissions are funded by the utilities they regulate, they are ultimately dependent on them for funding, and the political support of stakeholders may also be necessary to gain the support of the legislature. If the ERF system is to change the regulatory system for the better, it has to change behaviors both inside and outside the commission. On-going involvement of stakeholders in nearly all phases of the ERF system creation and implementation is paramount.

7. Establishment of a communication and outreach program. Any persons involved in the types of major change implied by ERF systems require constant and repeated information in a variety of formats. As an example, the NEB has created a newsletter, "The ERF Connection," to inform the public and stakeholders of ERF progress and developments.

The net result of these required initiatives is that an ERF system designed to accomplish the far-reaching goals that may be necessary for ERF justification will quickly migrate outside the commission information systems office. As an example, a project at Ericsson, a Swedish producer of telecommunications equipment, appeared to be dominated by technology; in fact, 80 percent of the work was not information technology related.[82] To reiterate, ERF systems, like any large-scale information systems, are business systems first and information systems second. They will, necessarily, involve nearly all aspects of commission operations and touch all stakeholders. They will require leadership from the top of the commission and from key stakeholders, changes in behavior by users, a commitment to learn the system, the training opportunities to learn new skills, and ongoing and persistent communications and dialogue.

Reducing the Costs of ERF

Given multiple desired outcomes and the complex set of initiatives required to realize them, full implementation of ERF represents a sizable challenge to regulatory agencies. The entire regulatory community would, no doubt, like to realize these benefits, but the fact remains that some agencies may be required to make a more

[82] John Thorp and DMR's Center for Strategic Leadership, *The Information Paradox: Realizing the Business Benefits of Information Technology*, 56-57.

modest foray into ERF as a starting point for later, more ambitious undertakings. Regulatory agency budgets are not unlimited, and tradeoffs may need to be made in system complexity, functionality, and cost.

Can a regulatory agency undertake ERF in a manner that fits within the commission budget and resources? Those state agencies cited earlier in this chapter believes so. For a regulatory agency attempting to begin ERF with limited resources, the keys are summarized in Figure 2.4; they are:

- Choosing a simple input format. SGML/XML has been articulated in this chapter as the "gold standard" in ultimate ERF functionality. It is not the least expensive option. The PDF-based system created by the Michigan Public Service Commission was completed in a very short timeframe using in-house staff.

- Building on the lessons learned by other commissions. Valuable lessons have been learned by those states that have begun ERF implementation. In some cases, the systems they created can be exported to others. Certainly, their knowledge can reduce costs for those who follow them.

- Pilot testing and phasing in ERF systems. Most of the agency systems described early made use of pilot tests to identify problems and resolve them inexpensively. Utilities willing to participate in trials and share their expertise with the commission may be available.

- Using in-house resources if possible. In some cases, vendors provide cost-effective systems expertise, expertise that can be eliminated once the project has been completed. But, if a regulatory agency is attempting to create a low-cost ERF system, the best option might be to identify and use in-house expertise. That expertise might be in the information systems office or elsewhere in the commission. Though most commission staffs are overworked, the creation of an ERF task force of internal staff might produce useful expertise without the need for additional staffing or budget.

- Employing iterative system planning and development methods. Some planning and system development methods produce incremental results and can be scaled to fit resource constraints. Extreme Programming, a development method that can be phased and constantly amended, is described in Chapter 4.

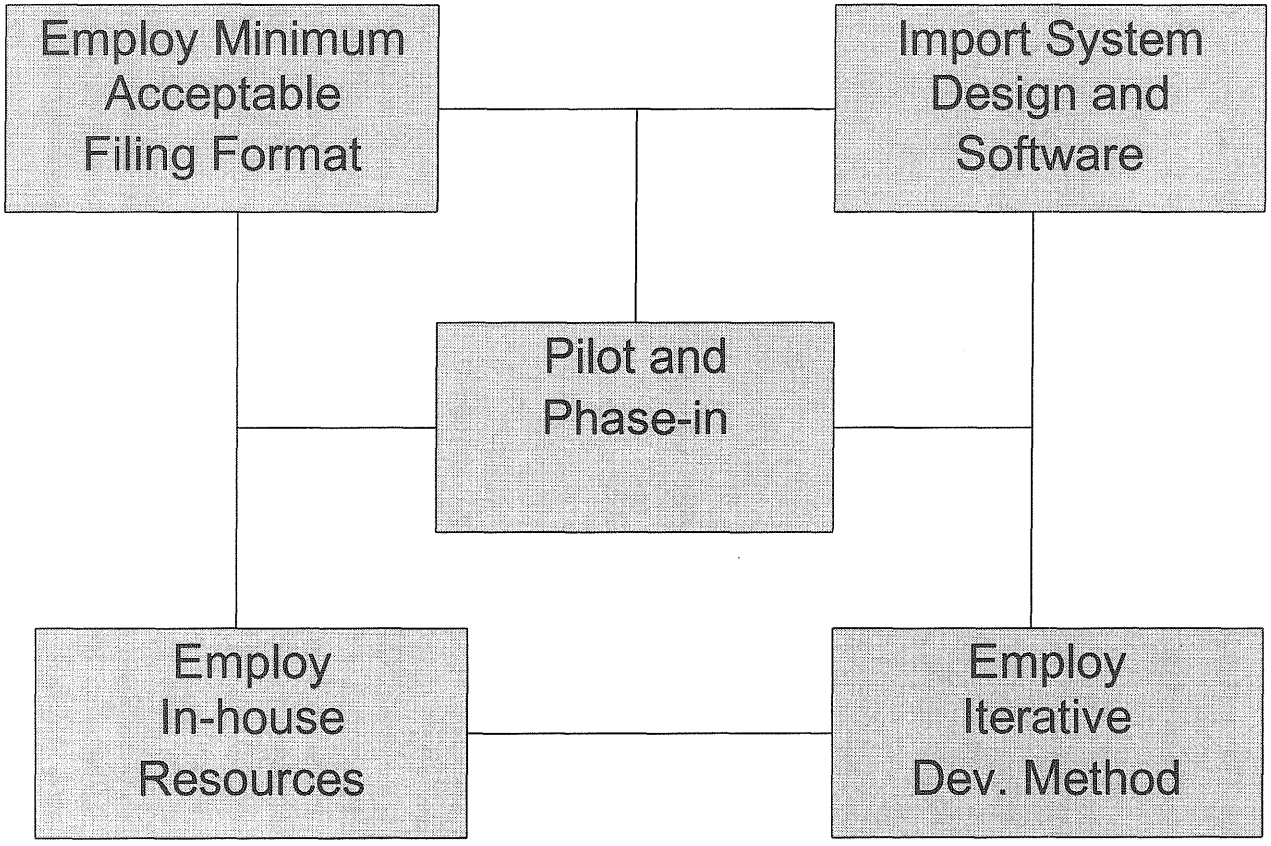

Figure 2.4: Reducing the Up-Front Cost of Electronic Filing

Source: Author's construct

ERF Conclusions

Given modern information systems technology and the volume of documents used in the regulatory process, the application of electronic file transfer technology to public utility regulatory commissions is natural and, I believe, inevitable. That does not imply that the migration from paper-based regulation to electronic regulation will be simple or inexpensive.

The complexities of ERF, which were described earlier in this chapter, will complicate state development and implementation, and variations in state circumstances will require step-wise ERF system application. Unfortunately, the greatest benefits of ERF may only accrue with the development of "high-end" ERF systems and national standardization and data portability. That national standardization will be discussed in the final chapter of this report.

In the meantime, regulatory commissions can learn from the leaders in ERF development, pursue ERF opportunities, as they are available, explore new technologies, and plan for the day when national ERF is a possibility.

CHAPTER 3

THE NEXT GENERATION OF REGULATORY INFORMATION SYSTEM APPLICATIONS

The Task of Enhancing the Process of Regulation

This report has thus far described the application by regulatory commissions of tariff filing systems, customer complaint tracking and management systems, docket and case management systems, geographic information systems, ERF, and full-function electronic commerce. It has been argued that these systems, while useful and the product of hard work and expertise on the part of commission information systems staff have not changed the nature of regulation. For the most part, they have automated existing commission processes and, in some cases, modestly changed the way commissions manage information.

According to Peter Drucker, that is the way that technological innovation typically precedes–by routinizing traditional functions. It is only later, when the innovations have begun to manifest social and psychological affects, that new ways of doing things arise and society is substantively impacted.[83]

If the systems discussed in the first two chapters of this report don't have the capacity to change regulation in substantive ways, what information systems might follow routinization? This chapter attempts to answer that question by exploring four general types of systems that might, individually or in combination, have the ability to substantially change the way regulatory agencies perform their roles or enhance the decision-making capabilities of regulatory commissions. Though these systems cannot be expected to be implemented immediately, they might be put in place in the next three to five years. Those four systems are:

- Knowledge management, which includes data warehousing and mining, document warehousing, and text mining.

[83] Peter Drucker, "Beyond the Information Revolution," in Andrew Leckey and Marshall Loeb, *The Best Business Stories of the Year: 2001 Edition* (New York, NY: Vintage Books, 2001), 365-380.

- Electronic facilitation of collaboration, which can be augmented by knowledge management systems.

- Regulation by information, which exploits the ability of information to serve regulatory functions by combination of the capabilities of knowledge management and collaborative support systems.

- The facilitation of utility market operations, which includes improvements in EDI/OSS and creating "smarter" networks and "autonomous" markets.

These systems might have the potential to shift the focus of commission information systems from merely processing regulatory actions to playing a more central role in the substantive work of the commissions. They are not, however, magic bullets that will free regulation of human interaction. Because information systems are social systems, each of them is dependent on the wisdom and skills of regulatory stakeholders. These systems will be discussed in turn.

Knowledge Management

There is no shortage of information in the regulatory environment. It is available on commission websites, in libraries, in electronic and paper files, stacked on and under nearly every horizontal surface at commissions and industry offices, and lodged in the minds of regulatory stakeholders. The problem is to collect that information, index it, mine it for useful information, and provide it to the right people at the right time.[84]

Fortunately for the regulatory process, managing information and extracting knowledge[85] from it are common and increasingly important business requirements. Finding patterns in data, analyzing documents and numbers, and rapidly creating value from available information are becoming the key drivers of corporate profitability in this electronic age. Some argue that an entity's knowledge base is

[84] Drawn from a conversation with Michael E. Porter, Chief Information Officer of the Illinois Commerce Commission, April 10, 2001, Springfield, Illinois.
[85] Information can exist separately from the human user; knowledge is information that is coupled with the needs, abilities, and capacity for action of the user. It resides in the user.

becoming the only sustainable strategic advantage in an era of rapid change. One of the biggest drivers in the knowledge management movement is e-government.[86]

According to Yogesh Malhotra, knowledge management "caters to the critical issues of organizational adaption, survival, and competence in the face of increasingly discontinuous environmental change. It embodies organizational processes that seek a synergistic combination of data and information-processes, capacity of information technologies and the creative and innovative capacity of human beings."[87] It requires managing information content, information interfaces, and business intelligence support.[88]

The key to knowledge management is, therefore, to provide information within a useful context, paying full attention to cultural norms, individual needs, and patterns of human communication so that users can convert that information to knowledge. Though technology enables knowledge management, it is only a small part of knowledge management applications. Knowledge management is principally a cultural endeavor, driven by the need to determine what needs to be known for effective decision making and inducing employees to gather that information, share it, and participate in the collaborative use of it.[89]

Because knowledge management is such a critical business and government function, techniques have been developed to maximize the use of the knowledge available to an enterprise and to expand the information available. Two of those techniques–data warehousing and mining and text warehousing and mining are explored here to create an understanding of their potential application to regulation.

Data Warehousing and Mining

According to ESPN, NBA coaches use data warehousing and mining to identify competitive advantages, to examine data from unique, nonstandard

---

[86] Trish Williams, "Government Knowledge Management Initiatives Gain Foothold," *Newsbytes.com*, March 9, 2001.
[87] Yogesh Malhotra, "Knowledge Management for the New World of Business," available at www.brint.com/km/whatis.htm, April 2, 2001, 3.
[88] Valaria P. Vendrzyk, Rumy Sen, and Tarun K. Sen, "How Management Accountants Assess the Quality of Data Warehouses," *Management Accounting Quarterly*, Spring 2001, 30-31.
[89] Eric Berkman, "When Bad Things Happen to Good Ideas," *Darwin*, Vol.1 No.7, April 2001, 52.

perspectives to gain new insights into how their teams perform. Retailers use them to identify likely customer responses. Bankers use them to detect credit card fraud. Medical facilities use them to identify successful treatment regimes. Amazon.com and Blockbuster video use them to recommend products to their customers. WalMart uses them to manage its suppliers.

What are data warehousing and data mining? Data warehousing is the process of assembling data useful to the enterprise. A data warehouse is a central depository of data, though data warehousing is different from the assembly of a big database, particularly those databases that are assembled for transaction processing. Data warehouses typically include internal operational and transaction data, external data like macroeconomic data and industry data, and metadata, which is data about the data itself, such as database design.

Data warehouses are designed to support ad hoc data analysis and inquiry and reporting by end users without the need for the involvement of programmers, interactively and on-line.[90] These types of searches are called On-Line Analytical Processing (OLAP). Data warehouses:[91]

- Have a subject area orientation
- Integrate data from multiple, diverse sources
- Allow for analysis of data over time
- Allow for ad hoc reporting and inquiry
- Provide analysis capability for decision makers
- Improve performance for analytic queries
- Allow for continuous planning
- Relieve processing burdens on transaction oriented databases

[90] Available at www2.andrews.edu/dw/ITS/dw/Andrews/WhatIsDW.html
[91] D. Heise, "Data Warehousing at Avondale College," available at www2.andrews.edu/~dheise/dw/vondale/ACDWTOC.html, 15.

- Relieve the development burden on systems staff
- Convert data into strategic information

With a data warehouse in place,[92] data mining can begin. Data mining is the process of analyzing data from different perspectives and summarizing it into useful information. Technically, it is the process of finding correlations or patterns among dozens of fields in large relational databases. Data analysis software employing a variety of techniques for sorting and classifying the data assists the mining process. Data mining has four components:

- Selection of the data and inclusion of it in the warehouse
- Providing users access to the data in a manner that does not require programmer input and allows self-defined queries
- Using application software to analyze the data
- Presenting the data to the user in a useable format

Data mining attempts to identify:

- Associations–correlations between predetermined data elements
- Sequences–patterns in the data over time
- Classes–assignment of data records to groups
- Clusters–segmentation of records according to a set of criteria or logical relationship. (Unlike classes, the group to which the records are assigned is not known before the operation in clustering.)

[92] In some cases, where enough data is available, the creation of a data warehouse is not required for data mining. Nonetheless, data mining assumes the existence of data to be mined.

Figure 3.1 identifies four regulatory data types (customer data, company data, regulatory data, and market data) and identifies the kinds of information that might be found if these four data mining operations were conducted on each data type.

Text Warehousing and Document Mining

As shown, data mining might have considerable utility for the regulatory environment. However, much of the information in the regulatory environment is in the form of documents, not numeric data of the variety usually included in a data warehouse. Fortunately, text warehousing and document mining have very recently emerged as systems that have the potential to meet the knowledge management needs of those organizations in which data is largely textual.

Document warehouses can draw on documents from any source. Documents included in a warehouse might include complete documents from both internal and external sources, automatically generated summaries of documents, translated documents from foreign sources, thematic or topical indices, and metadata about documents.[93] Further, the document warehouse may contain documents of different types; documents from different sources; documents from which dominant themes, key features, and summarized content has been drawn; and documents that are linked by theme, indexed by features, and grouped in clusters.[94] With a document warehouse, it is possible for an enterprise to gain richer business intelligence, know customers better, monitor the macroenvironment, and assess emerging technologies.[95]

Document or text mining employs statistical techniques to structure and organize the documents in the warehouse. Running counter to the mythology that

---

[93] Dan Sullivan, *Document Warehousing and Text Mining* (New York, NY: Wiley Computer Publishing, 2001), 10.
[94] Ibid., 13-19.
[95] Ibid., 25.

Data Relationship	Data Type: Customer Data	Company Data	Regulatory Data	Market Data
Associations	Link between customers and svc. preferences	Introduction of advanced. svc. and complaints	Link between reg. action and price increase	Link between capacity short. and price caps
Sequences	Sequence of advanced svc. demand	Rate actions following mergers	Rate actions following restructuring	Capacity changes after restructuring
Classes	Underserved customers	High cost utility svc. providers	"Successful" commissions	Highest impact of capacity shortage
Clusters	New segment of customer market	New class of utility providers	New group of dissatisfied consumers	New at-risk market segment

Figure 3.1: Examples of Data Mining in Public Utility Regulation

Source: Author's construct

text is unstructured, text mining uses morphology (the study of the structure and form of individual words), syntax (the study of how sentences are structured), and semantics (the study of meaning) to develop systems that use language rules and word meanings. It creates document summaries, creates semantic networks that extract the meaning of texts, uses word frequencies to find the most important ideas in a document, identifies correlations between word use, and employs macrostructures to organize long, complex documents.[96]

One of the best macrostructures for deriving the meaning from large, complex documents is the application of markup language. One of the most widely used is XML, which we encountered earlier in this report. These markup languages, which also include HTML and SGML, allow for the imposition of structure into documents. Markup language pointers can identify locations within a document and can link structures.[97]

Regulatory Application of Knowledge Management

The Illinois Commerce Commission (ICC) has developed a knowledge management initiative. The ICC system will consist of four components:[98]

- Universal Search and Retrieval Capability: Provides for a universal search engine capable of word searching across multiple document repositories, databases, and metadata files.

- Conversion and Indexing of Historical Documents: Provides for the identification, capture, and indexing of selected historical documents and related material.
- Online Analysis, Annotation, and Linking of Related Documents: Provides the capability to annotate electronic documents with notes, references, or other pertinent information and the capability to create a story line or thread through multiple documents to facilitate the online analysis, review, or presentation of a particular topic or issue.

- Digital Enhancement of the Bench: Provides under-the-counter computer monitors and analytical software capabilities for the use of commissioners and hearing examiners during hearings and related proceedings and

[96] Ibid., 30-45.
[97] Ibid., 45-50.
[98] Illinois Commerce Commission, "New IT Initiative Worksheet: Draft Work Papers," November 2000, 1-2.

explores the capabilities of hand-held, wireless devices for accessing and reviewing pertinent materials.

According to the ICC, most technical reviewers of pertinent regulatory documents spend 60-80 percent of their time searching for and gathering documents and the remainder of their time performing the actual review. The ICC knowledge management initiative seeks to reverse those percentages.[99]

If knowledge management system initiatives are successful and if finding pertinent documents can be made simpler and more complete, knowledge management systems have the potential to deepen analysis and improve regulatory decision making.

Electronic Facilitation of Collaboration

The United States has a unique policymaking and regulatory style, a style that may not best serve the American public. According to Robert A. Kagan of the University of California Center for the Study of the Law and Society, the U.S. policymaking and regulatory style, when compared to other regimes,[100] is characterized by:[101]

- More complex legal rules
- More formal, adversarial procedures for resolving disputes
- Slower, more costly forms of legal contestation
- Stronger, more punitive legal sanctions
- More frequent judicial review of and intervention into administrative decisions

---

[99] Ibid., 2.

[100] Based on Kagan's studies, the ranking of countries by process costs is the United States, Canada and Germany, the Netherlands, Sweden, Belgium and the United Kingdom, and Japan. C. Leigh Anderson and Robert A. Kagan, "Adversarial Legalism and Transaction Costs: The Industrial-Flight Hypothesis Revisited," *International Review of Law and Economics*, 20 (2000), 6.

[101] Robert A. Kagan, "Adversarial Legalism and American Government," *Journal of Policy Analysis and Management*, Vol.10, No. 3, 372.

- More political controversy about (and more frequent change of) legal rules and institutions

Searching for a handy summary rubric for these legal propensities, Kagan labeled them "adversarial legalism," a method of policymaking and dispute resolution characterized by comparatively high degrees of:[102]

- Formal legal contestation–disputants and competing interests frequently invoke legal rights, duties, and procedural requirements, backed by the threat of recourse to judicial review and enforcement.
- Litigant activism–the gathering and submission of evidence and the articulation of claims is dominated or profoundly influenced by disputing parties or interests, acting primarily through lawyers.
- Substantive legal uncertainty–official decisions are variable, unpredictable, and reversible; hence adversarial advocacy can have a substantial impact.

This adversarial legalism has its costs, which include extraordinary costs, delays, the extortion of unjustified concessions, deadlock, and social inertia.[103]

Recognizing these characteristics, some public utility regulators have attempted to create more collaborative regulatory regimes. They have employed informal settlements, mediation, arbitration, negotiated rule making, workshops, and technical conferences in order to attempt to break the cycle of confrontation that has affected public utility regulation. Thus far, however, their successes have only marginally changed the regulatory environment, which, it can be argued, is still largely dominated by Kagan's adversarial legalism.

Collaboration, the process of shared creation,[104] is a lofty goal for those involved in the public utility regulatory process. Regulation is typically regarded as an analytic or problem-solving exercise, not a creative one. As commissions move further away from taking actions that affect individuals or single firms and toward regulatory actions that affect entire industries or groups of firms, they have less need for the due-process-protecting procedures that spawn confrontation. Commissions

---

[102] Ibid.
[103] Ibid., 375-377.
[104] Michael Schrage, *No More Teams: Mastering the Art of Creative Collaboration* (New York, NY: Currency Doubleday, 1995), 33.

will never completely abandon the types of processes that require due-process protection and an adversarial process; they will always be in the business of enforcement, which implies the application of sanctions and the maintenance of due-process protections. But as utility industries are restructured and as the bounds of creativity in the policy making process are expanded, the use of collaborative methods as an option to adversarial legal processes should increase.

Typical regulatory commission processes, organizations, and staffing are not conducive to collaboration. Collaboration, according to David Mamet, is a creative process of equals.[105] Typical government organizations, with clearly defined levels of hierarchy, mitigate against the operation of equals. Many commission staff gained their professional expertise in an era of confrontation with utilities, and vice versa. As a result, regulatory processes mitigate against the kinds of flexibility and continuous, unstructured interaction that collaboration requires.

Commission information flows also mitigate against collaboration. As indicated by Figure 3.2, regulatory information flows are based on information reduction. Utilities select information to be presented to the commission, commission staff request specific subsets of information for their analysis, and, in the end, the case record places a box around the information that can be included in consideration. Conversely, collaborative processes are always aimed at gathering new information of various types and from varied sources, creating models that enhance and amplify information, and jointly analyzing information for methods and models that expand the decision "outside the box."

Figure 3.3 illustrates a more open flow of communications that might better facilitate collaboration. This information-flow model presumes that data can be gathered from shared data sources that utilize common platforms and architectures. The extraction process, a knowledge management process, allows the most useful information to be collected, aggregated, and summarized. With that data in hand,

[105] Ibid., 28 citing David Mamet.

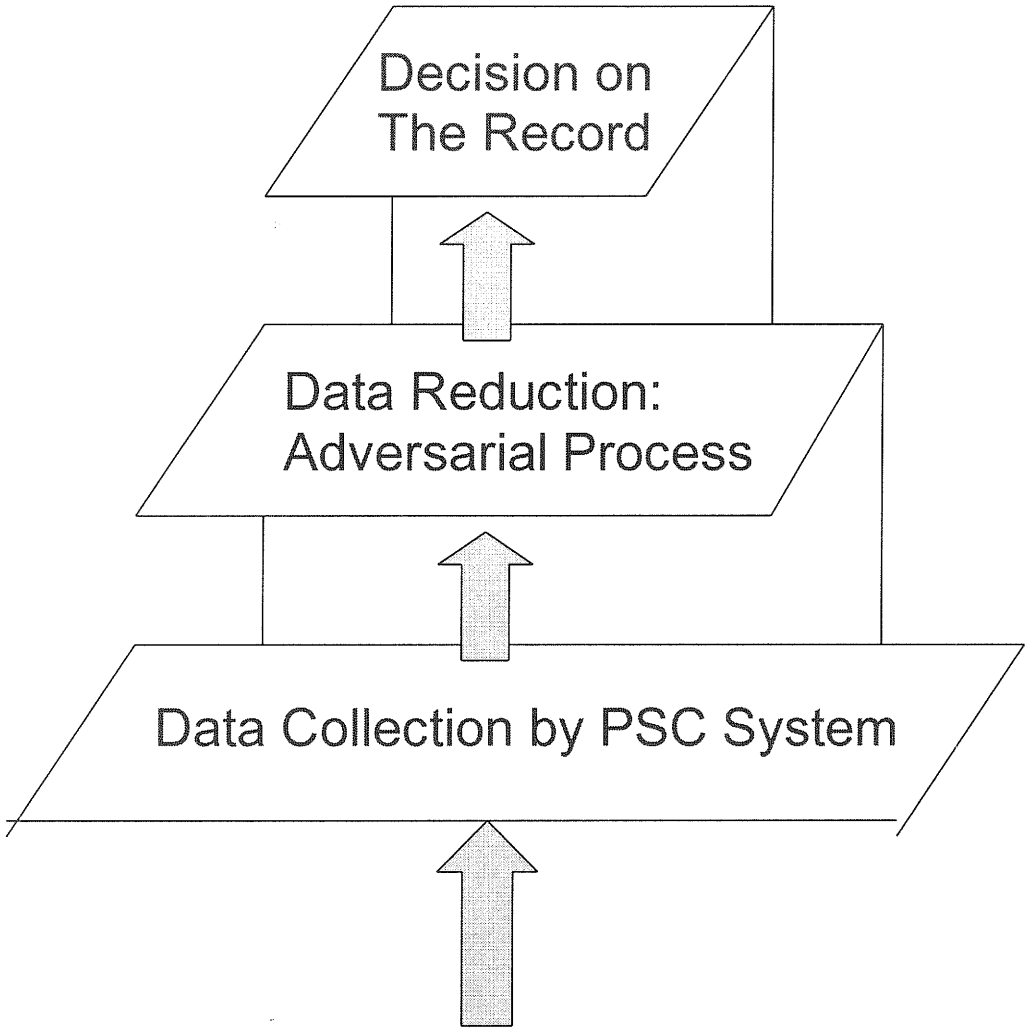

Figure 3.2: Traditional Regulatory Information Flows

Source: Author's Construct

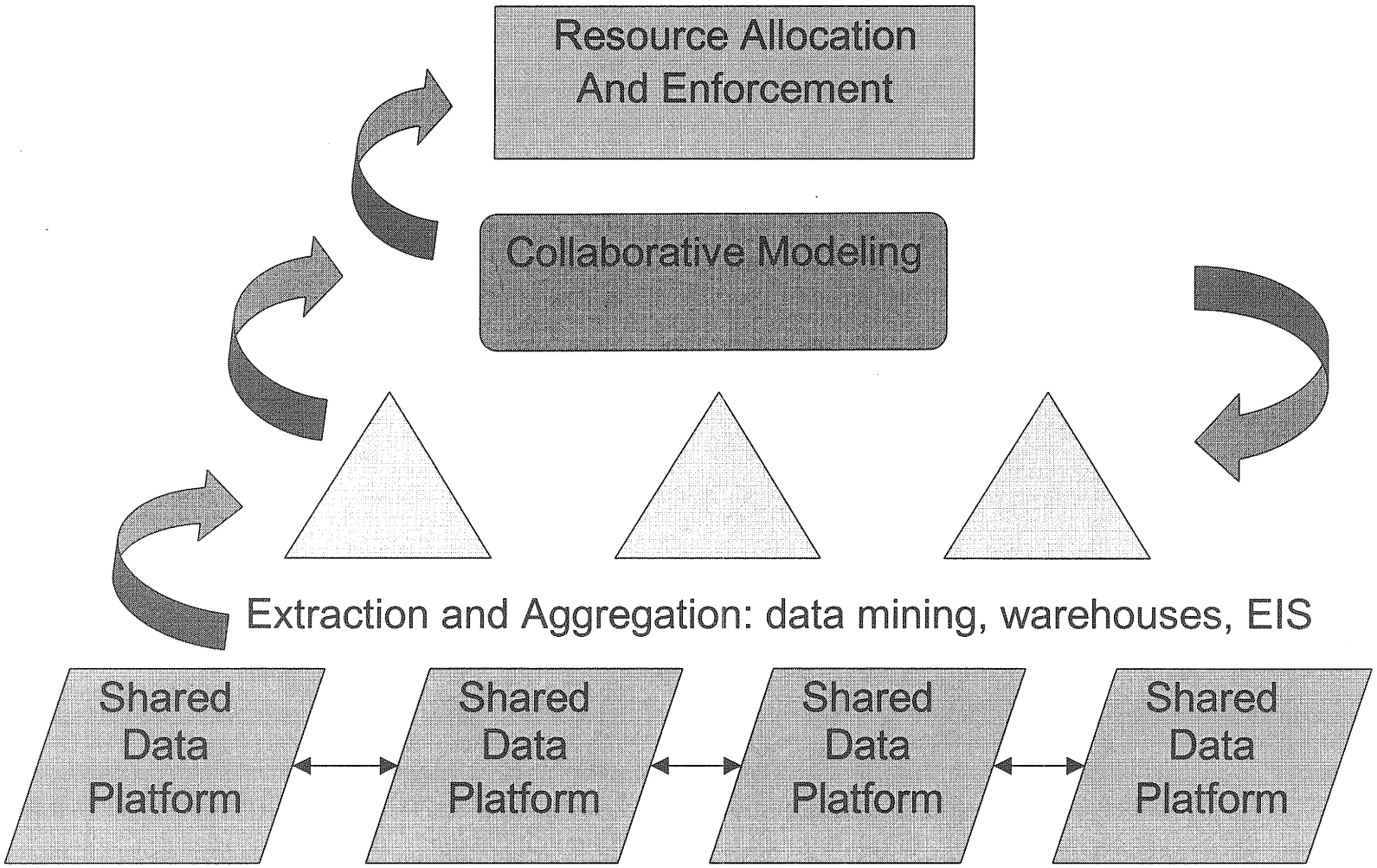

Figure 3.3: Collaborative Process Information Flows

Source: Author's Construct

collaborative modeling can take place with the goal of creating win-win models. The modeling process is iterative, requiring additional data extraction and aggregation as the modeling process unfolds. Where consensus cannot be reached and enforcement of standards and compliance is necessary (as will almost certainly be the case in any complex, high-stakes collaborative effort), government action is required to allocate resources and take necessary enforcement action.

Collaboration is not the same thing as working in teams. Teams are hierarchical; they function through the making of assignments, dividing tasks, and specialization. Collaboration is voluntary, and all participants have equal rights to shape all parts of the solution. The keys to collaboration appear to be access to a shared creative space and the ability to share ideas and amend solution sets. What may be necessary to jump-start the application of collaboration in the regulatory environment are collaborative tools. These collaborative tools, which may be as simple as a blackboard[106] or as sophisticated as advanced computer software, can help the collaborative process by:[107]

- Creating shared space
- Allowing for modeling and rapid prototyping (i.e., rapid experiencing of "what if" scenarios)
- Keeping track of iterations of the model and conversations about it
- Allowing ideas to be experienced
- Complementing verbal and visual expression
- Creating shared understandings (i.e., conversation is vital but not enough)

Today, these collaborative support systems allow for real-time communications among far flung workers, help organize information, and provide

[106] Ibid., 88. According to Schrage, there has not been a fundamental advance in blackboard technology in 500 years with the exception of colored chalk. Despite the lack of progress, the blackboard is one of the most widely used collaborative devices found in the office of most world-class researchers.
[107] Ibid., 90-96.

visualization capacity, a version of that key shared space so critical to collaboration at any level. They can provide real-time conferencing with application sharing, web-based conferencing, document and knowledge management tools, chat and instant messaging applications, group calendars, and web-based project management. They can reduce the need to travel.

These electronic systems help law firms thrash out complex negotiations and make complex deals. Ernst and Young team members can exchange messages, share documents, and jointly mark up documents from around the world as if they were in the same room.

The implications for public utility regulation are obvious. Currently, the regulatory community convenes most frequently in the shared space of the hearing room, a hierarchical venue hardly suited to real collaboration. Creating open electronic venues for gathering the collective wisdom of the community and eliciting input into models might bring a new sense of creativity to regulation that might lead to innovative and shared solutions. Software tools may provide better opportunities to create lasting and consensus-based solutions to complex regulatory problems.

Regulation By Information: Creation of Regulatory Libraries

Knowledge management systems of the variety described earlier could be developed to serve the internal, analytical needs of commissions. Those systems could be structured, as well, to be publicly available and to integrate a variety of data platforms. Integrated with decision making methods (e.g., standard commission processes or collaborative models), they might provide an alternative regulatory regime or, at a minimum, support the current regime with information and collaboration. The result would be a version of regulation by information.

Models of regulation by information are not new. The Massachusetts Board of Railroad Commissioners, created in 1869 in an era in which discriminatory pricing was a major regulatory concern, issued no binding orders except for orders to produce information. The Commission's first chairman, Charles F. Adams, was convinced that in many cases, "regulation by publication was a sufficient form of

control."[108] European regulatory agencies under the European Union also rely heavily on information rather than orders and prohibitions more fully than U.S. regulatory systems.[109] In the U.S., the Securities and Exchange Commission relies extensively on the creation of a strong information network for the creation of effective securities markets that protect investors.[110]

Though some models of regulation by information assume mere provision of provider information, like prices and contract terms, to consumers so that they can make wise choices, a more sophisticated model of regulation by information enabled by current electronic information technology could bring together vast amounts of information in order to inform and reduce the risk of decision making at all levels. In this information age, what might be created is the electronic equivalent of the local library for public utility regulation. This virtual, electronic regulatory equivalent of the local library would not be able to serve all regulatory functions, like enforcement, but could inform, simplify, and enhance much regulatory decision making.

The local library model is an appropriate analogy for regulatory information sharing because local libraries:

- Increasingly, serve as "communities of information" where resources and assistance are available (i.e., libraries are both information systems and social systems)
- Largely provide "pull" information services (one shortcoming of local libraries is their limited ability to "push" information to users prior to the patron's request)
- Provide safe, neutral space for community meetings and group study
- Apply uniform national standards for information filing
- Are linked to one another to maximize resource availability and sharing

[108] Giandomenico Majone, "The New European Agencies: Regulation by Information," *Journal of European Public Policy*, 4:2, June 1997, 265-266.
[109] Ibid., 265.
[110] For a more extensive discussion of regulation by information, see also David Wirick, *New Models of Regulatory Performance: The Diversity Imperative* (Columbus, Ohio: National Regulatory Research Institute, 1999), 43-62.

- Are funded independently from other local government and are controlled by independent boards
- Attempt to meet the needs of all patrons through diverse information media and types
- Are neutral
- Select and make available the most useful information (i.e., no library attempts to make every resource available) as determined by expert staff

Figure 3.4 illustrates the regulatory equivalent of the local library. It need not consist of physical assets or be centrally located though the regulatory equivalent of librarians, those who can manage information requests and assist users if they need assistance,[111] could be co-located or geographically dispersed. Though a web portal, information sources can be linked and accessible from any location. The library can operate at an international, national, regional, or state level.

This library model brings together regulatory, legal, economic, financial, consumer, and provider data into a knowledge management system, which is its hub. With knowledge in hand, collaborative regulatory processes, enabled by collaborative software, are an option, though the system can feed and support more traditional regulatory decision making.

Like the local library, the electronic regulatory library would be open to all (with necessary protections for limiting access to restricted information), be able to be examined and searched by the user, contain diverse types of information and the capability to display the information in diverse formats, have the ability to search and gather information from remote sites, and provide the space and social systems for

[111] Recall that one important feature of knowledge management systems is the ability of the user to interact directly with the data. At the local library, patrons have the opportunity to conduct their own searches without the intervention of the librarian. Librarians help only those who need and request assistance.

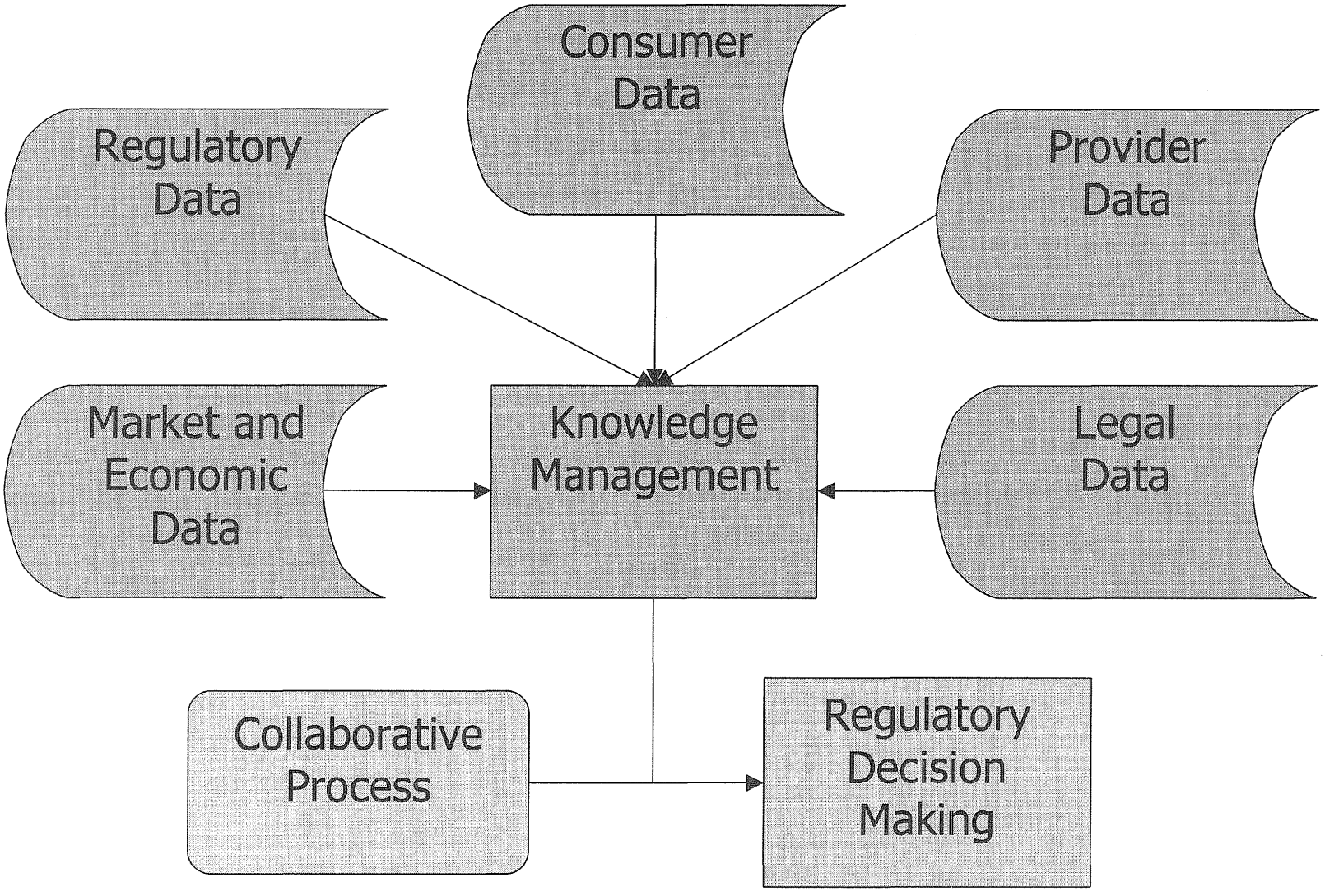

Figure 3.4: The Electronic Regulatory "Library"

Source: Author's construct

productive interaction between stakeholders. It would provide a means of informing regulatory processes and, in some cases, supplanting them with a more productive venue for dialogue.

Facilitation of Competitive Markets

Competitive markets require the free flow of information, and many of the efforts to infuse more competition into utility markets have involved the attempt to create more effective flows of information attendant to those markets. The concerns over operational support systems (OSS) in telecommunications and electronic data interchange (EDI) in energy markets are, at their core, concerns about information systems.[112]

It might be difficult for some to envision how improved electronic information systems might actually improve the operation of utility markets, a considerable leap from their ability to merely change how those markets are regulated. Three of the possibilities are:

- Changing the structure of OSS/EDI. The "backroom" functions of the incumbent utility were not built to be accessed by or available to outside parties, and opening them has been fraught with difficulties and complaints. To date, the solution imposed has been to attempt to ensure that competitors receive services that are in parity with the services these systems provide to the incumbent provider who operates and owns them. If the OSS/EDI systems operated by the incumbent provide poor response to customer needs, this solution, at best, exports that poor response to the competitor. In order to be effective, these systems must be timely, accurate, and reproducible. Since OSS/EDI transactions are information exchanges, enhanced information systems might be able to streamline processing. Standardization might enhance data exchange and entry of new participants. Armed with sophisticated information systems, third parties might be able to play a role in improving the interface between the competitor and the customer, a relationship that must be effectively exploited if competition is to succeed.

[112] OSS and EDI refer to the "backroom" functions of the utility service provider. They include service orders, billing, provisioning, maintenance and repair, and relationship management.

- Creating "smarter" utility networks. The Electric Power Research Institute (EPRI) is engaged in exploration of the creation of energy networks of the future. According to Steve Silberman's description of the EPRI vision:[113]

> The smarter energy network of the future, EPRI believes, will incorporate a diversified pool of resources located closer to the consumer, pumping out low- or zero-emissions power in backyards, driveways, downscaled local power stations, and even in automobiles, while giving electricity users the option to become energy vendors. The front end of this new system will be managed by third-party "virtual utilities," which will bundle electricity, gas, Internet access, broadband entertainment, and other customized energy services. Now the digital networks will be called upon to remake the grid in their own image. By embedding sensors, solid-state controllers, and intelligent agents throughout this new supply chain, the meter and the monthly bill will be swapped out for something more robust, adaptive, interconnected, and alive: a humming, real-time, interactive energy marketplace.

- The creation of "autonomous" markets. It is highly likely that autonomous agents (known as "bots") will play an increasingly important role in helping sort through the mass of information that human beings are confronted with and handle intricate human tasks. These bots are already at work, in Internet search engines, web-based retailers, and, even on the home computer desktop. MySimon.com and DealTime.com scour the web for the best prices at thousands of stores.[114] One study indicates that by 2005, twenty-five percent of home computer users will allow personal agents to anticipate their needs. Pattie Maes has identified three functions that bots can handle: product/information brokering (i.e., gathering information, indexing information, mining information, and processing information), merchant brokering (i.e., roaming the net, finding the best price, and making "buy" recommendations), and negotiations over prices.[115]

  The use of bots can present problems. They can mislead, are best applied in the exchange of commodities where quality considerations do not exist, and face considerable limitations in the process of

[113] Steve Silberman, "The Energy Web," *Wired*, July 2001, 116.
[114] "Site vs. site," *Darwin*, April 2001, 106.
[115] John Seely Brown and Paul Duguid, *The Social Life of Information* (Boston, MA: Harvard Business School Press, 2000), 36-49.

> negotiations.[116] Nonetheless, if bots are employed, not to replace human agents, but to supplement and complement them, the application of bots might hold significant promise.[117]
>
> Would it be possible for bots to seek the best rate for each long distance call as it is dialed? Could bots search for the best rate for energy on a day-by-day or hour-by-hour basis for residential consumers? These capabilities may be some time away but clearly within the realm of technological feasibility.

For the application of these types of market altering technologies, it is apparent that the technological capability will arrive long before institutional market structures are able to accommodate them. The technology is either available now or will be soon. The application of these technologies to public utility markets is mostly dependent, therefore, not on the ability of information technologies to change utility markets, but on the ability of market regulators to create market structures that accommodate the optimal use of technology.

Conclusions

The systems discussed in this chapter may be the ones that move regulatory information systems beyond automating transactions and organizing information flows. They may be the systems that enhance and change the regulatory process. On the other hand, they may be replaced by better, emerging options.

What is certain is that information systems must eventually change the process of public utility regulation in much the same manner that they have changed many of the ways that business and the business of government is conducted. To expect public utility regulation to continue without fundamental change caused by information technologies is naive.

---

[116] Ibid., 41-51.
[117] Ibid., 62.

CHAPTER 4

REGULATORY INFORMATION SYSTEMS PLANNING AND MANAGEMENT

Minding the Gap

Identifying the potential benefits of regulatory information systems of the variety discussed in the last two chapters may be the easy part. All too often, there is a gap between the identification of a system that has a high potential to render value and its effective implementation. That gap can be closed by good information systems planning and execution.

For sophisticated information system applications, planning and execution are not easy in the best of times. Even in the private sector, the information environment is typically a disaster.[118] As system complexity increases, planning and implementation difficulties increase geometrically.[119]

In addition to the normal difficulties associated with the creation and implementation of sophisticated systems, regulatory commissions suffer from several additional impediments to good planning and information systems application, impediments that exist despite the best efforts of information systems staff. This chapter explores those impediments, first focusing on information systems planning models, including an innovative model applied by the Illinois Commerce Commission (ICC), and, second, examining several information systems management issues that negatively impact the ability of regulatory agencies to maximize the benefits of electronic information systems.

Information Systems Planning

Information systems are high-cost items that, far too often, fail to achieve full integration into the strategic direction of the organization and fall short of their

---

[118] Thomas H. Davenport with Laurence Prusak, *Information Ecology: Mastering the Information and Knowledge Environment* (New York, NY: Oxford University Press, 1997), 47.
[119] See Chapter 1 for a list of indicators of system complexity.

potential because of inadequate information systems strategic planning. Without adequate planning, the organization will not make appropriate use of its resources, will fail to capitalize on opportunities, and will spend its information systems resources on the wrong types of systems. Without planning, no criteria will exist with which to judge the effectiveness of the organization's information systems efforts.

Information systems strategic planning is a complex, multi-level process that involves a wide array of activities and skills. As Davenport notes, strategy is a dialogue rather than a document.[120] Table 4.1 identifies the levels of information systems strategic planning and the typical activities and dialogue required at each level for comprehensive and effective systems strategic planning.

According to Anita Cassidy, the purposes of information systems strategic planning are to:[121]

- Effectively manage an expensive and critical asset of the organization.
- Improve communication between the enterprise as a whole and the information systems organization.
- Link information systems direction to the business direction.
- Plan the flow of information and processes.
- Efficiently and effectively allocate information systems resources.
- Reduce the time and expense of the information systems life cycle, which includes vendor review and selection, project approval, implementation, maintenance, and systems enhancement.

Logical, forward-looking planning processes are sometimes compromised in public organizations by the exigencies of time and resources available to public sector organizations. Often, despite the intentions of information systems staff, the planning model adopted by public sector organizations fits into one of the following categories:

---

[120] Thomas H. Davenport with Laurence Prusak, *Information Ecology: Mastering the Information and Knowledge Environment*, 47.

[121] Anita Cassidy, *A Practical Guide to Information Systems Strategic Planning* (Boca Raton, Florida: St. Lucie Press, 1998), 3-8.

Table 4.1

Public Information System Strategic Planning Levels and Activities

Information System Planning Level	Activities
Stakeholders	Demand assessment, education regarding options and potential
Political	Generating support, approval, and resources
Design	System design, identify system requirements, story telling
Users and participants	Training, obtaining feedback, securing buy-in
Application	Identifying software capabilities, selecting software and applications, programming
Hardware	Identifying hardware capabilities, selecting and installing hardware
Testing	Testing the system and providing feedback
Integration	Creating linkages between systems

Source: Author's construct

Budget-cycle planning. Too often, information systems planning is relegated, with other government agency planning processes, to "feeding numbers" into a biennial or annual budgeting process. Those plans, often created in haste and in order to satisfy the higher-level, "budget planning methodology *du jour*," fail to provide the detailed examination of information systems needs and possibilities.

- Sequential replacement planning. In some cases, government information systems planning is reduced to a process of phased upgrades of equipment and systems judged to be in need of replacement or upgrade rather than a consideration of systems needs. The result is incremental budgeting and incremental improvement of existing systems and applications. It is difficult under this type of system to generate interest in and funding for new initiatives.

- Next-technology planning. Information systems planning can fall victim to next-technology planning, in which technology investment decisions are essentially determined by the next generation of technology introduced by the market. If the technology market sequentially develops products that continue to meet agency needs, this variety of planning may work. At its worst, it allows the market to determine information systems directions for the agency.

- "One-off" planning. In "one-off" planning, information systems managers are satisfied if budget planning is generally adequate–that it is one variation off from real needs. Planning and budget estimates may be based on incomplete data and untested assumptions. Once the budget is acquired, funds are shifted to attempt to meet the agency's real needs. In a stable environment, in which next year's information systems budget is likely to see an incremental increase over last year's, one-off budgeting may have been adequate. As information systems become more central to the agency's ability to deliver services and more expensive, one-off planning is less likely to be effective and less likely to be tolerated by budget managers.[122]

These models take a very limited view of information systems planning. They presume that information systems planning is a function that can be isolated to the information systems office and staff and that effective planning is merely a process of coming up with the right set of numbers. Better planning models integrate

[122] John Thorp and DMR's Center for Strategic Leadership, *The Information Paradox: Realizing the Business Benefits of Information Technology* (Toronto, Canada: McGraw-Hill Ryerson Limited, 1998), 21-22.

information systems with the business needs of the organization, its strategic direction, and its communications patterns. Good planning systems address human dynamics and four common myths about information systems:[123]

- Technology manages information. (Technology is a medium for relationships; people use information as they see fit.)
- The distribution/transmission/processing paradigm is adequate for the description of how information systems impact the organization. (Exchanging information isn't the same as sharing it.)
- All information systems, by definition, promote information sharing and collaboration. (Most systems promote isolation and individualism.)
- The majority of change in advanced information technology applications is technological. (The biggest change is people.)

These factors require the creation of information systems planning methodologies that integrate plans with the direction of the organization, its people, and its patterns of communications rather than separate information systems planning from the rest of the organization as is too often the case. Fortunately, there are a number of information systems planning models that are superior to the faulty ones described earlier and that meet these requirements. Four models–Systems Development Life Cycle, Gap Analysis, Benefits Realization, and Extreme Programming–are discussed in turn in the following sections.

Systems Development Life Cycle

The Systems Development Life Cycle (SDLC), which is also referred to as Information Systems Development or Application Development, is a straightforward approach to business problem solving. Illustrated in Figure 4.1, SDLC has three essential steps: analyze, design, and implement. Other versions expand the three terms to add other steps, which merely add more detail to the model.

[123] These mythologies are drawn from Michael Schrage, *No More Teams: Mastering the Dynamics of Creative Collaboration* (New York, NY: Currency Doubleday, 1995).

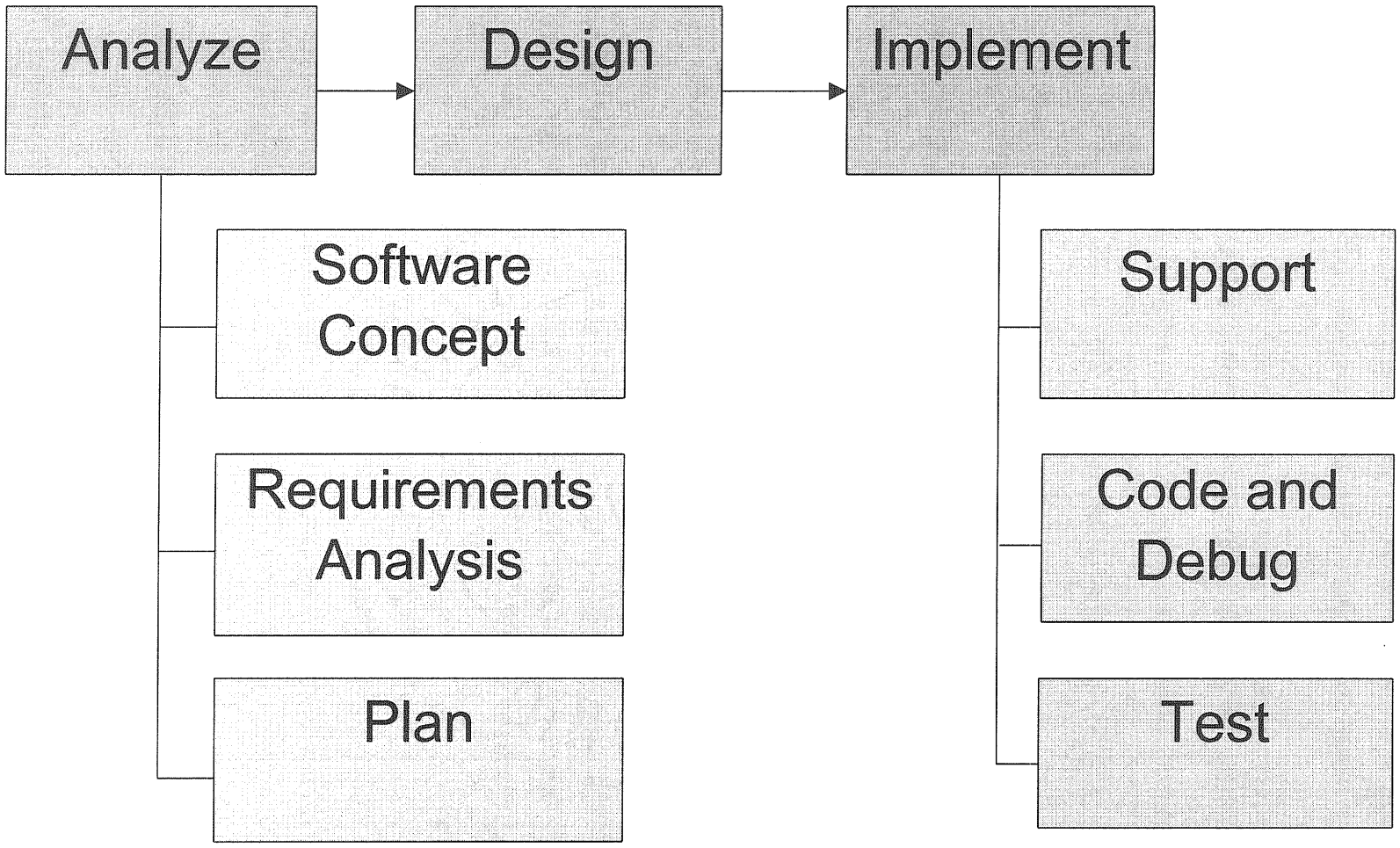

Figure 4.1: Systems Planning Models: SDLC

Source: Author's construct

The analysis phase consists of identifying the need for the system, the information needs of users, the organizational environment, any systems in use, and identifying functional requirements of the system.

In the design phase, hardware, software, people, and data resources necessary for the system are identified, and a blueprint of a system that will meet the functional requirements identified in the analysis phase is crated. Information system professionals are largely responsible for the design phase but must work with users so that their work can be reviewed and problems detected before they are built into the system.

In the implementation phase, code is written and debugged and the system is tested. Conversion of old data to the new system and training employees are other activities of this phase. Finally, end users will need to determine whether or not the system meets their needs.

SDLC can be iterative and does not change appreciably if the decision is made to out-source the system rather than develop a system in-house. Good planning, integrated with constant user interaction, is critical. A good business-case argument for the system is imperative and must be constantly updated.

Gap Analysis

Gap analysis, illustrated in Figure 4.2, is a higher level planning model the goal of which is to develop a conceptual plan for development of an information systems strategy. Its four basic steps are:[124]

- Identification of where the organization is today, considering the overall business perspective as well as the information systems perspective.
- Identification of where the organization wants to be in the future, again from a business and information systems perspective.
- Exploration of the "gap" between where the organization wants to be and where it currently is from both perspectives.

[124] Anita Cassidy, *A Practical Guide to Information Systems Strategic Planning*, 18.

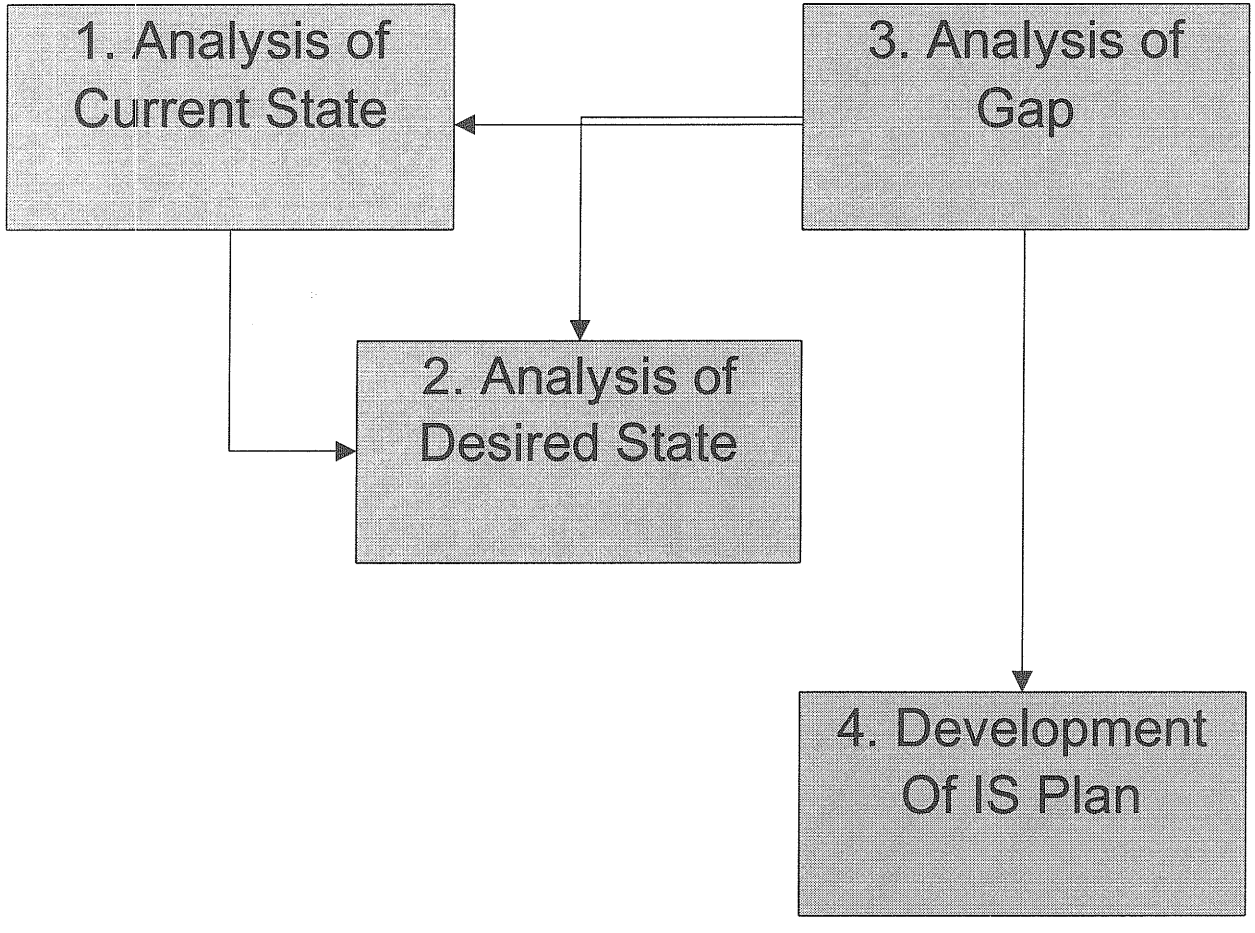

Figure 4.2: Systems Planning Models: Gap Analysis

Source: Author's construct

- Development of plans that detail how the organization is going to get to where it wants to be from an information systems perspective.

Following from this process is the development of a conceptual information systems plan and a set of detailed information systems recommendations.[125]

Benefits Realization Approach

The Benefits Realization Approach was developed by the DMR Consulting Group and was designed to enable organizations to select and manage a portfolio of information systems programs such that benefits are clearly defined, optimized, and harvested. It is based on the ideas that the benefits of information systems don't happen automatically (that they are not "magic bullet" solutions), that benefits rarely accrue according to plan, and that benefits realization is a continuous process of envisioning results, implementing, checking intermediate results, and dynamically adjusting the path leading from investments to business results.[126]

The Benefits Realization Approach rests on three fundamentals:

- A shift from stand-alone information systems management to business program management. Programs are structured groupings of projects designed to produce clearly identified business results or other end benefits. The focus is not on the projects but on the steps necessary to produce the desired results. Though typical project management ends with the delivery of the technology, programs are focused beyond technology to benefits delivery.[127]

- A shift from free-for-all competition among projects to disciplined portfolio management. Portfolios are structured groupings of investment programs designed to achieve defined business results while meeting clear risk-

[125] Ibid., 23-25.
[126] John Thorp and DMR's Center for Strategic Leadership, *The Information Paradox: Realizing the Business Benefits of Information Technology*, 37-38.
[127] Ibid., 42-43.

reward standards. The idea is to manage the portfolio so that a stream of benefits, similar to investment returns, is produced. The information system portfolio should include investments that touch all elements of the business system, not just information technology elements. The focus is on the alignment of high-level outcomes of information investments with business objectives. Programs within the portfolio need to be analyzed to create the right mix of investments, monitored based on changing objectives and results, and dropped or added as necessary.[128]

- A shift from traditional project management cycles to full cycle governance. Full cycle governance is distinguished from normal information systems management by its longer time frame from the initial concept to the receipt of benefits and by a process of progressive resource commitments in which resources are committed to programs in small increments. Full cycle governance employs a set of defined "stage gates," which are points where decisions are made to continue, modify, or cancel programs. These stage gates are designed to encourage the search for new benefits opportunities as the environment changes. They also allow for incremental management of risk, since programs applying new technologies are only funded one step at a time.[129]

Two techniques that support the Benefits Realization Approach are benefits modeling (of the variety exhibited for ERF in Chapter 2 of this report) and value assessment, which supports valuation and selection of programs in the portfolio and ongoing management of the portfolio.[130]

Extreme Programming

Extreme Programming (XP) is an information system planning and management model that is receiving much attention today and is anything but "extreme" in that it applies sound communication with users and a logical progression of tasks. Figure 4.3, provided by the ICC, illustrates the ICC's version of XP. XP has been largely credited to Kent Beck, who has written a number of books on XP, two of which are simply referred to by XP practitioners as "The White

[128] Ibid., 43-44.
[129] Ibid., 44-45.
[130] Ibid., 46.

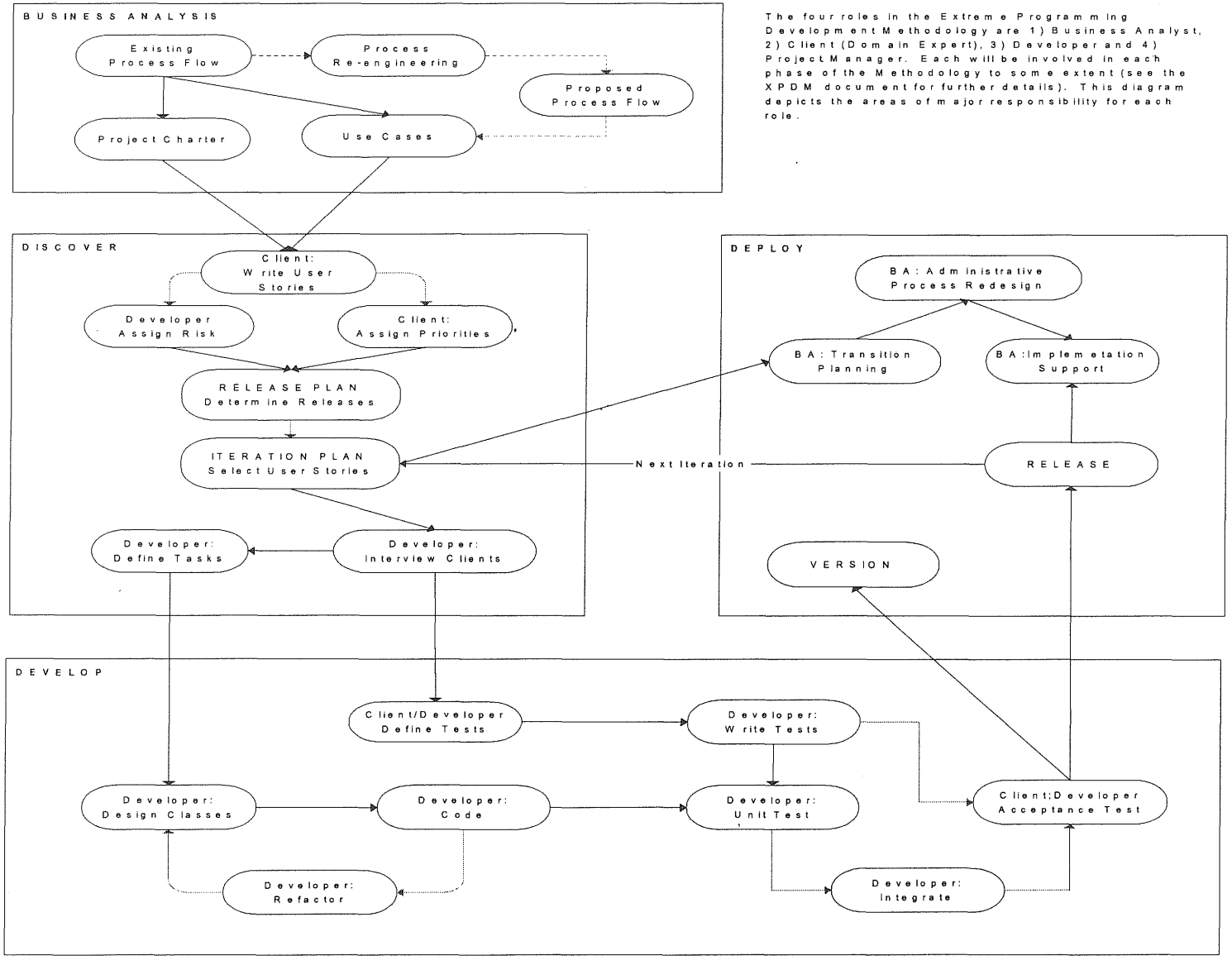

Figure 4.3: ICC Version of Extreme Programming

Book" and the "Green Book."[131] XP is driven by four fundamental driving forces: communication, simplicity, feedback, and, according to its proponents, courage. It works best for projects involving small sets of programmers (two to ten). What sets XP apart from other systems planning methodologies is:[132]

- The development of user stories. XP begins with a dialogue between information systems staff and users in which users don't design systems or identify systems specifications or requirements but simply tell the stories of their business needs in their terms at a fairly broad level of detail. Optimal user stories are short–about three sentences of text in the user's language. About 80 user stories (plus or minus 20) allows for the creation of a release plan for stages of the system. Users are involved at every step including in the release planning meeting at which user stories are prioritized in the order in which they will be addressed.

- The development of small deliverables. In XP, there is no attempt to fully anticipate the totality of a user's needs and create a macro system that meets all of those needs. In XP, systems designers merely attempt to create system releases that meet only the most basic user needs identified in the user stories. These small releases provide a sense of accomplishment often lacking in big projects and allow more frequent feedback. No system functionality is added before it is needed. Success is measured by project velocity–the number of user stories addressed in the period.

- The use of metaphors. For each XP project, an overall, coherent theme is developed, which may be expressed in terms of a metaphor. The metaphor provides the broad sweep of the project; the stories describe individual features.

- Simple design. The best system design in XP is the design that most simply delivers today's functionality. The adage employed by XP developers is DTSTTCPW ("do the simplest thing that could possibly work").

- An iterative process. With XP, projects proceed in incremental steps as systems addressing user stories create functionality. This allows for changes in system design, refinement of user needs over time, and an ongoing dialogue. Each iteration begins with iteration planning.

---

[131] The White Book is Kent Beck, *Extreme Programming Explained; Embrace Change*; the Green Book is Kent Beck and Martin Fowler, *Planning Extreme Programming*.

[132] This analysis of XP is largely drawn from "Extreme Programming," *e-business application delivery,"* April 2001, available at www.cutter.com/ead/ead0002.html.

- Refactoring. Projects are continuously refactored with each iteration. That is, software is redesigned on an ongoing basis to improve its responsiveness to change.

- Pair programming. Programming of the system is done by programmer pairs, which allows for a dynamic interchange while programming is being conducted. Pair programming allows for communal ownership of the code. It appears to be the most controversial aspect of XP.

The ICC is currently exploring its own version of XP for use in future systems initiatives. Its version of the XP methodology combines the use of XP with a Business Analysis group reporting to the CIO. The Business Analysis group performs up-front business process analysis and re-engineering to optimize the business solution prior to initiating the software development process. This team meets with users, examines business requirements, identifies legislative mandates, and addresses the cultural and behavioral aspects of the proposed information management change. This effort establishes a collaborative environment between the business unit, the Chief Information Officer, and the information systems department.[133]

XP requires an advanced set of skills for information systems staff. Not only are they required to be adept at creating systems, under XP they are required to be good listeners and communicators and to understand the role of stories and metaphors.

None of the planning models described above presents a magic bullet for planning for and meeting the systems needs of regulatory agencies. They all have their strengths as well as their limits, and the best systems planning model for a regulatory agency will be the one that best adapts to local circumstances and needs. Critical issues for most public utility commissions are (1) finding a method that shortens the information systems planning cycle enough to take advantage of technological opportunities and (2) breaking out of the common budgeting and legislative assumption of incremental change from existing systems.

[133] Conversation with Michael Porter and others at the ICC, Springfield, Illinois, April 10, 2001.

Information Systems Management Issues

Unfortunately, in addition to the planning impediments described above, regulatory agencies (and most public agencies) must cope with several information systems management issues that may further inhibit their ability to make optimal use of information technologies. This report has already addressed three issues–changing the behavior of staff and stakeholders, shortening the planning cycle, and identifying the benefits and value of complex information systems projects. Four other management issues (recruitment and retention, the use of consultants, the organization of the information systems function, and generating financial resources) are now discussed in turn.

Recruitment and Retention of Information Systems Staff

According to the Gartner Group, market demand for relevant information technology skills will outstrip supply through 2004, and those information systems professionals that are available are inspired by cutting-edge technologies and will be attracted to firms with an aggressive technology approach.[134] Seven hundred and sixty thousand open positions for skilled information system professionals went unfilled last year.[135] Obviously, these facts do not bode well for the ability of regulatory agencies to recruit and retain staff necessary for the development and operation of sophisticated information technologies.

Unfortunately, no simple answers exist for solving recruiting and retention problems for commissions. Government salaries are likely to lag behind the private sector, and the private sector will be able to dangle attractive inducements before those with critical skills. Some partial solutions for regulatory agencies might be:

- Creating new classification schedules for information systems staff or generating the ability to make exceptions to classification and hiring rules (e.g., advanced step hiring). A variant of this option is the use of non-

[134] Barb Gomolski, the Gartner Group, "Building Effective IS Organizations in Difficult Times," presentation handouts, State of Ohio, March 2001.
[135] Robert Lavery, "The ABCs of ASPs," *Strategic Finance*, May 2001, 49 citing International Data Corporation.

systems classifications (e.g., utility analyst) for technology staff if that use is allowed by human resource authorities. (No suggestion is made here to create "stealth" employees, who perform work far outside their classification, or to inflate the ranks of management in order to offer manager salaries to non-management staff.)

- Providing training for key staff in new technologies. Investing in training for existing staff might be more cost-effective than hiring consultants and may increase staff retention.

- Identifying career opportunities for information systems staff. Recruiting may be easier and retention more likely if systems staff can see the potential for career progression.

- Allowing greater workplace flexibility. Dress codes have been eliminated or reduced at many regulatory agencies. Depending on the needs of individuals, flexible working hours or work-at-home programs might be useful.

- University outreach. A few regulatory commissions make extensive use of students from local universities to perform systems tasks. Often these students come to the job with high skill levels and the need for work experience.

- Making the commission an exciting place for information systems staff. The act of committing to the exploration and application of cutting edge technologies may make work more interesting and challenging for staff.

The Use of Consultants

At some commissions, consultants are used for major system initiatives. At others, consultants are used as regular information systems staff and perform normal, daily functions like training and systems maintenance because of the difficulty in recruiting and retaining staff with necessary skills. The use of consultants can be a productive, cost-effective way to engage resources that may not be necessary for long periods of time or to "staff up" to meet system development peaks. When consultants become a permanent fixture of the information systems unit, problems can arise. They include:

- Management control. Consultants may not have the same allegiances as commission staff. Consultants may have two supervisors–the commission supervisor and their firm supervisor. On the other hand, they may be more responsive if their contracts can be terminated easily and other consultants found.

- Price. Consultants work at market prices, which may be significantly more expensive than commission salaries. If staff cannot be hired to perform necessary systems functions, consultants may be "the only port in the storm" but may be an expensive port.

- Pay equity. In one government information systems office (not a regulatory agency), a consultant who has formed his own one-person company is paid over $100 per hour to perform the same functions as agency employees making far less. These disparities have a deleterious effect on the morale of regular staff.

- The potential for conflict of interest and allegations of favoritism. Contracting is one of the thorniest legal and ethical issues for government agencies, particularly if the contracts are long-term, subject to quality, rather than merely price, criteria, and present employment opportunities for those involved with the contractor.

- Political liability. The media have publicized and criticized the extensive use of consultants by one agency in Ohio (not a regulatory agency).

As in the case of recruiting and retention, there may be no easy answers to the use of consultants. If mechanisms can be found for effective control and management of consultants, regulatory agencies can consider the adoption of "IS Lite," a management method described by the Gartner Group. In IS Lite, organization staff focus their efforts on vendor management, technology advancement, business enhancement, architecture development, and systems leadership. Consultants are employed for actual systems development and programming.[136]

In the ultimate expansion of the consultant model of information system operation, regulatory agencies could rely on application service providers (ASPs). ASPs, which are growing quickly, function much like the service bureaus that once provided access to mainframe systems and software on a time-sharing basis. ASPs

[136] Barb Gomolski, the Gartner Group, "Creating and Leading the Next Generation of IS Organization," presentation handouts, State of Ohio, March 2001.

manage software applications; house the hardware, software, and communications infrastructure; provide the software that runs the applications; and provide consulting, training, and implementation assistance. Advantages of ASPs are access to sophisticated applications, outsourced management, and vendor accountability. The disadvantages are some of the same disadvantages of the use of consultants listed above and the potential for a lack of familiarity with the applications that meet the unique needs of regulatory agencies. Critical features of ASP use are the business longevity of the ASP (i.e., will the ASP remain in business throughout the term of the agreement), the ability of the ASP to handle data and traffic volume, and data security by the ASP.[137] Whether or not any ASPs offer applications that meet regulatory needs is unknown. The key to ASP use may be the establishment of a comprehensive service level agreement (SLA).

The Organization of the Information Systems Function

An issue of concern to any business or government organization is the placement within the organization of the information systems function. Two basic models are available:

- Centralization of systems administration, support, and development. In this model, the expertise for systems administration, support, and development is centralized. Operating divisions of the organization are provided with fully developed solutions to problems they have identified, to provide a trivial example, much in the same way that office cleaning services are delivered. No operating division resources are required to be committed to systems issues. Advantages of this model are the ability to allow operating divisions to focus on their core functions without the distraction of systems building, the ability to centralize systems expertise, and the ability to control systems resources. The disadvantages are the communications barriers that may result between operating division staff and systems staff and the relative isolation of systems staff.

- The "federal" model. In this model, systems expertise is decentralized as much as possible. Central staff manage organization-wide networks, but system support and development happens within the operating divisions. Advantages of this model are that operating divisions can prioritize the use

[137] Ernest Pages, comments on the review of a draft of this report.

> of their own resources and that systems expertise is close to users. Disadvantages may be a lack of critical mass of systems staff in any location, disjointed development, the use of different standards and equipment, and resource asymmetry between operating divisions.

Most public utility commissions operate under some variant of the two, although the centralized model is more prevalent, in part because of the small size of many commissions. If they have the option, a natural tendency of operating divisions, operating under the centralized model, is to develop in-house, distributed expertise as a result of dissatisfaction with the work of the central information systems staff. Some commissions have made peace with this tendency and have developed some distributed systems expertise in operating divisions. Those systems "assistants" can solve immediate and simple problems and may provide a communications link to the central systems staff.

Information Systems Funding

Previous portions of this report have addressed information systems planning, which includes acquiring financial support for systems innovation. Because of the difficulty inherent in procuring adequate resources for systems initiatives, a separate consideration of that issue is warranted here.

Prying enough funding from state legislatures for major systems initiatives within the budget of a single state agency is clearly a problem. Major information systems endeavors, even if back-end cost savings can be demonstrated, may require substantial up-front investment, investment that may dwarf the standard "no more than an x percent increase for each agency" funding model. Regulatory commissions may have some advantage over other agencies in that their funding is usually passed directly through to utilities by assessment rather than requiring general fund appropriations. There are also three alternatives to the pursuit of funding by a single agency:[138]

[138] National Center for Electronic Commerce Coordinating Council in conjunction with the Center for Digital Government, "Electronic Commerce: A Blueprint for States," December 1999, 31-32.

- Creation of fee-based systems paid for by users. Users can be charged for information access. In a regulatory environment, access to information by stakeholders may be regarded as a right, thereby limiting the usefulness of this option. A regulatory alternative might be a special purpose levy on utilities for information system development. That option would likely require their agreement to participate in or support the new systems.

- Statewide innovation funds. Some states (Massachusetts, Maryland, and Louisiana) have developed versions of innovation funds, in which money is set aside at the state level, sometimes earmarked from specific taxes or fine pools, for information systems projects. Agencies then submit proposals for the available money, which resembles a grant. Innovation funds typically cover the start-up costs of a new initiative but not maintenance or upgrades. The function of an innovation program is to allow agencies to demonstrate the feasibility of a new program or application.

- Aggregation of funding requirements. Another approach is to aggregate funding requirements across several agencies or projects, presenting a single case to the legislature as part of a strategic initiative to move government online. Aggregation may occur as part of the operating budget or capital budget, which may allow bond sales to finance systems.

The Illinois Technology Office (ITO) has been instrumental in promoting the information technology initiatives of the ICC. The ITO, sponsored by the Governor's Office, spearheaded a statewide initiative to compile proposals for information technologies. The ITO creates a central planning process for information technologies, and creates what is almost a separate budgeting process for information technologies. ICC initiatives submitted to the ITO have been approved and funded for FY 2002.

Conclusion

Planning for and managing complex information systems may be more a matter of art than science. There are planning and management techniques that can assist, but, ultimately, the ability to realize the benefits of information technologies is a function of talent and communication. With enough resources, talent can be purchased. With patience and training, it can be developed.

Communication with users and stakeholders about needs, expectations, and even technologies cannot be worked around or purchased.

At the bottom line, the objectives of information technologies are human objectives, and the logic of information systems must be the logic of humanity.[139] They will succeed or fail based on the human response to them. Those regulatory agencies that are successfully building information systems have addressed the human dimension of information systems application and have proven the value of constant and open communications.

[139] John Seely Brown and Paul Duguid, *The Social Life of Information* (Boston, Massachusetts: Harvard Business School Press, 2000), 18.

CHAPTER 5

THE NEED FOR CONCERTED ACTION

Increasingly, regulatory issues and problems cross traditional boundaries. Power shortages in California cause problems for states throughout the West. Environmental issues affecting the East have roots in the Midwest. Telecommunications company mergers and acquisitions cross state and regional boundaries. Utility providers cross international boundaries to acquire companies and provide services in energy, telecommunications, and even water. Indeed, it can be argued that the biggest problem facing regulators today is the resolution of issues that do not fit the boundaries of the government entities tasked with dealing with them.

In this environment, the need for cooperation and coordination between and among regulatory agencies is paramount. The ability of those regulatory agencies to gather, share, and use information will be a key determinant in their ability to resolve problems in the public interest.

The types of regulatory information systems discussed in this report can be developed and applied within the borders of individual states. It makes far more sense, however, if states and the federal government pool their resources to seek solutions, agree on standard data formats, and, perhaps, embark on national data collection.

According to the National Electronic Commerce Coordinating Council:[140]

> The transition to electronic government will expose the inconsistencies that currently exist among agencies' standards if certain planning and protocols aren't adhered to. Consistent standards are important in order to ensure interoperability, compatibility and shared usage of electronic commerce resources. Consensus building also provides direction for the creation of standards on which the remainder of the electronic highway can be built.

[140] National Electronic Commerce Coordinating Council in Conjunction with the Center for Digital Government, "Electronic Commerce: A Blueprint for States," Version 1.0, December 1999, 27.

The argument for national and international cooperation with regard to regulatory information systems is fueled by the following arguments, which have been voiced throughout this report:[141]

- Electronic information technologies are reshaping commerce, the delivery of government services, and the interaction between citizens and their governments.

- The potential for electronic information technologies to impact society, business, and government is likely to continue to grow substantially into the future.

- The governors of many states have initiated efforts to make better use of electronic information technologies in the provision of government services.

- Many state public utility commissions have enhanced their internal information systems and begun the process of integrating electronic information technologies into the process of regulation.

- The potential for electronic information technologies to make the process of public utility regulation more efficient and effective has not been fully explored.

- Electronic information technologies may have the potential to transform for the better the process of public utility regulation.

- Standardization of regulatory information architectures may reduce costs and make information more transferable between jurisdictions.

- Effective public utility regulation in a rapidly evolving market will require the exchange of information between jurisdictions and new and better sources of information for policy makers.

- The complexity of issues and the volume of information available requires the development of effective knowledge management techniques and systems so that the best regulatory decisions can be reached.

- Electronic information systems have the potential to assist regulatory commissions in their attempts to develop policies and rules in a collaborative manner.

[141] A draft resolution making this argument and proposing the creation of some form of ongoing collaborative endeavor to examine regulatory information systems has been created and forwarded by the author to the NARUC Committee on Finance and Technology for its consideration at the Summer 2001 meetings.

- The provision of information to consumers is becoming an important function of state public utility commissions.
- The free flow of information is vital to the more competitive markets that are the goal of many public utility regulators.
- Many utility service providers operate in multiple jurisdictions with different filing requirements and have, themselves, installed electronic information systems.
- It is difficult for individual regulatory commissions to gather the resources necessary to fully explore and implement electronic information technologies.
- The legal impediments to the use of electronic filing are being reduced.
- Individual commission efforts to implement electronic information systems may be more costly than necessary because of a lack of information about options and the experiences of others.
- Policy makers, regulators, consumers, and utility service providers all stand to benefit from the cost-effective application of electronic information technologies to the regulatory process.
- National and international cooperation and coordination will be necessary if electronic information systems are to be applied to their maximum benefit.

This national effort could advance through a number of venues such as a NARUC working group, the equivalent of a Federal-State Joint Board, a university-sponsored endeavor, or a separate organization charged with coordination of the stakeholders. No matter how the effort might be structured, it could be tasked with activities such as:

- Conducting research and analysis of the potential for electronic information systems to improve and transform public utility regulation
- Encouraging dialogue among stakeholders on the appropriate use and potential of electronic information systems for public utility regulation
- Developing standardized information architectures and formats where appropriate

- Increasing awareness of the potential for application of electronic information systems to improve regulatory processes
- Creating a regulatory version of XML
- Identifying low cost options for information system implementation by state public utility commissions
- Developing templates for information system development and implementation
- Providing assistance to public utility commissions in information systems planning and implementation
- Considering issues of access by all segments of society to regulatory information systems and government services
- Compiling best practices in the application of electronic information technologies
- Developing valid cost-benefit arguments for information system application

NARUC has begun to develop data exchange standards. The Pennsylvania Public Utility Commission, the Delaware Public Service Commission, the Maryland Public Service Commission, the New Jersey Board of Public Utilities, the Public Utilities Commission of Ohio, the Virginia State Corporation Commission, and the District of Columbia Public Service Commission have banded together to maintain uniform criteria for exchanging electronic information between electric companies, generation suppliers, and other service providers with regard to electronic data interchange (EDI).[142]

More comprehensive information coordination efforts have been undertaken in other areas of government responsibility. For example, both the state of Kansas and the state of North Carolina have developed comprehensive information architectures for their state agencies. The Kansas Statewide Technical Architecture (KTSA) describes the information architecture that supports applications used by the state, ways in which state applications and strategies are developed and deployed in Kansas, the ways in which information is delivered to users, and the standards and

[142] National Association of Regulatory Utility Commissioners, "NARUC Bulletin," No. 9-2001, April 30, 2001, 6.

information systems services within state agencies and to other governments that need to communicate with Kansas state government.[143] The North Carolina system allows "individual departments to respond to specific business needs using common components, thus ensuring that information systems will be shared and managed on a statewide basis."[144]

A collaborative effort cannot, of course, mandate uniformity in architecture as these states have done for their agencies. It could, however, create voluntary standards, much in the same way NARUC has created accounting standards which are adopted or amended by its members.

Another example of national information system coordination is the "Uniform Regulation Through Technology" initiative undertaken by the National Association of Insurance Commissioners (NAIC). The NAIC system, which is illustrated in Figure 5.1, collects regulatory, company, and consumer data and enhances information standardization through the use of reciprocity agreements and uniform regulation through coordinated processes. The components of the NAIC system are:[145]

- Exam Tracking System (ETS): Stores examination (audit) information that can be shared by states.
- Regulatory Information Retrieval System (RIRS): Contains a database of regulatory actions taken against companies.
- Special Activities Database (SAD): Contains a collection of information that can be used for investigative purposes.

---

[143] State of Kansas, Information Technology Executive Council, "Kansas Statewide Technical Architecture," Version 8.0, July 2000, III-IV.
[144] National Association of Government Archivists, "State Technology Architectures," available at www.nagara.org/crossroads/2001_1.html, March 2001.
[145] Information about all of the elements except CAFRA was identified at www. naic.org/ 1UniformRegulation. Information about CAFRA was found in Rob Gurwitt, "The Riskiest Business," *Governing*, March 2001, 22.

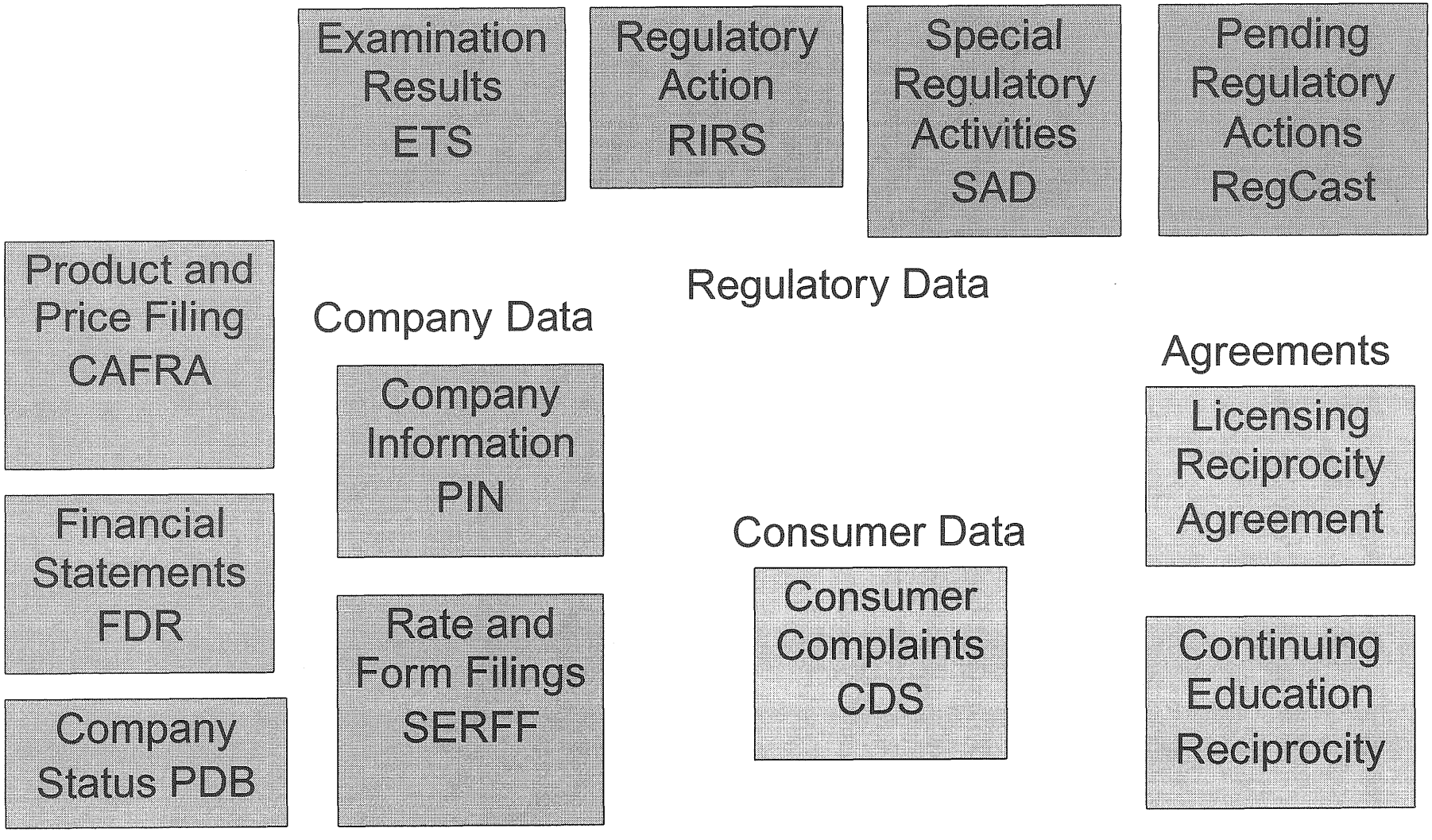

Figure 5.1: NAIC Uniform Regulation Through Technology

Source: Created from data contained on NAIC Website

- Pending Regulatory Actions (RegCast): Distributes pending state regulations and model NAIC laws for review and feedback.

- Coordinated Advertising, Rate and Form Review Authority (CAFRA): A one-stop product and price filing system. A multistate review committee will evaluate a product; regulators in the participating states can then opt to conduct their own reviews within 45 days.

- Financial Database Repository (FDR): Stores more than 5,000 U.S. domiciled insurance companies' annual and quarterly financial statements.

- Producer Database (PDB): Contains information related to insurance agents and brokers. This system will ultimately also link to other sources such as the National Association of Securities Dealers databases.

- Producer Information Network (PIN): Facilitates the electronic exchange of information between regulators and companies. Data standards will be developed for license application, license renewal, and appointment and termination information.

- System for Electronic Rate and Form Filings (SERFF): Enables insurers to submit rate and form filings electronically.

- Complaints Database (CDS): Used for referencing and analyzing consumer complaints. Contains more than 1.3 million closed complaints.

- Uniform Treatment/Licensing Reciprocity: A project intended to address the multi-state licensing system currently in place. When adopted, states will agree to license agents and brokers who are in good standing in their state of residence.

- Continuing Education Reciprocity: A project to create agreement on the part of states to accept continuing education credit given to a course by another member state.

The insurance industry, of course, differs in significant ways from public utility regulation, though they may, in time, converge. For example, the insurance business delivers less of a commodity than some assume that utility service providers deliver, and, as a result, insurance providers are more interested in developing relationships with customers than are utility service providers. As utility markets are opened to greater degrees of competition, the numbers of utility providers will increase, utility products will be less of a commodity and will begin to

vary more, and the relationship between providers and consumers will become more critical to business success.

As a result of the current differences between insurance and public utility regulation, public utility regulatory stakeholders may not find use in all of these systems or in the centralized approach to data collection that is implied. Public utility regulators may, however, find a lesson in the NAIC system for proactive information system development and coordination.

NARUC has a history of successful national and international cooperation and coordination. Because of the explosion of information systems potential and the importance of information to the regulatory process, NARUC has yet another opportunity to serve the public interest through collaboration.