NRRI 96-11

TELECOMMUNICATIONS SERVICE QUALITY

Vivian Witkind Davis, Ph.D.
Senior Policy Analyst

Larry Blank, Ph.D.
Economist

David Landsbergen, Ph.D.
School of Public Policy and Management

Nancy Zearfoss
Graduate Research Associate

Raymond W. Lawton, Ph.D.
Associate Director

John Hoag
Doctoral Candidate

THE NATIONAL REGULATORY RESEARCH INSTITUTE
The Ohio State University
1080 Carmack Road
Columbus, Ohio 43210
(614) 292-9404

March 1996

This report was prepared by The National Regulatory Research Institute (NRRI) with funding provided by participating member commissions of the National Association of Regulatory Utility Commissioners (NARUC). The views and opinions of the authors, or mentioning of a specific product, service or firm by the authors do not necessarily state or reflect the views, opinions, policies or endorsements of the NRRI, the NARUC, or NARUC member commissions.

EXECUTIVE SUMMARY

Up to now, Americans have enjoyed the highest quality telecommunications service in the world. State regulatory commissions have helped to make it so. The enormous changes underway in the telecommunications industry present complex challenges to maintaining high-quality service. The purpose of this report is to delineate some of the newly emerging issues in telecommunications service quality and suggest policy approaches. We conclude that the role of commissions is evolving toward relatively less concern with economic regulation and more with protective regulation. In economic regulation, suited to monopoly market conditions, a government agency specifies the rules under which a company can operate and the prices it may charge. In protective regulation, competitors exist but government intervention is needed to make up for market imperfections, such as limitations on information available to consumers.

For telecommunications, the most important dimensions of quality are availability, reliability, security, flexibility or choice, simplicity and assurance. All of these are affected by innovations in technology, the development of a competitive market structure, and interconnection of the competitors in a network of networks. The many new issues facing consumers, companies, and commissions may be addressed through market, industry or governmental controls.

Companies compete on the basis of quality as well as price, and customers are better served by effective competition than by unchecked monopoly. Companies with monopoly power are likely not only to provide less variety in the services they offer but to distort levels of quality and discriminate against low-end customers. Given the opportunity, the telecommunications firm that retains market power will tend to reduce quality for users of basic services in order to encourage the purchase of better service by those able to afford it.

Some of the most important decisions on telecommunications service quality are being made by organizations made up of users and producers in the industry.

Policy makers need to understand the process of setting technical standards and consider participating because the process is a political one with important impacts on society.

As the form and applicability of economic regulation changes, state regulatory commissions have been strengthening protective regulatory controls on quality. More than 30 jurisdictions have initiated or revised quality of service standards since the AT&T divestiture. Fourteen of them reported that they tie their new or revised standards to an alternative regulation plan. Several use weighted indices of quality. Sixteen commissions reported problems with enforcement of standards.

Of the three general control mechanisms that govern quality of service, market solutions are, naturally, the preferred choice for goals that have to do with economic efficiency. In the absence of a market, however, regulatory controls are still necessary for consumer service standards and to mediate intra-industry conflict when interconnectors have difficulty meeting network quality needs. Nor is industry able to meet equity objectives, including redistribution of service availability from urban to rural, rich to poor, or intergenerationally, as national goals for availability of the information infrastructure and economic development might dictate. Finally, government has a role in measuring and reporting on quality where industry does not, in order to make up for deficiencies in information flows whether or not the market is competitive.

Regulators will want to: (1) carefully distinguish between competitive and noncompetitive markets and services and tailor their oversight of quality of service to market conditions; (2) explore participation in the industry standard-setting process; (3) where markets and services remain monopolies, strengthen protective regulation, particularly enforcement of quality of service standards; (4) where markets and services remain monopolies, examine a minimum subscribership form of regulation, and (5) develop new means of informing the public about the degree and type of telecommunications quality available.

State regulatory commissions have over a century of experience in economic regulation, assuring a fair rate-of-return on the fair value of their investment for stockholders and affordable rates for customers. Protective regulation, the *raison d'être* for many well-established government agencies, has lived in the shadow of traditional economic regulation. As we move towards an era of a network of networks in telecommunications, a new emphasis on protective regulation is needed to assure Americans of the quality they want. We suggest approaches to doing so which may well require not only a reprioritization of regulatory goals but new programs and reallocation of resources.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

TABLE OF CONTENTS (CONT.)

TABLE OF CONTENTS (CONT.)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (CONT.)

FOREWORD

This research report should be of both immediate and long-term relevance to state regulatory commissions. Telecommunications service quality has been a matter of some urgency this past year for many commissions, and the report will no doubt be of interest to them. In setting up a broad framework for analyzing and dealing with the many policy issues associated with quality of service considerations, the report should be helpful to all the commissions for several years to come.

Douglas N. Jones
Director, NRRI
Columbus, Ohio
March 1996

ACKNOWLEDGMENTS

The several authors of this report wish to acknowledge the information and comments provided by many members of the NARUC community. Alan Taylor, Chair of the NARUC Staff Subcommittee on Telephone Service Quality, and Barbara Alexander, Chair of the NARUC Staff Subcommittee on Consumer Affairs, provided many helpful observations on drafts of chapters as they were developed. Ron Choura of the Michigan Public Service Commission and Guy McDonald of the Kansas Corporation Commission did the same. Commissioner Bob Rowe of the Montana Public Service Commission gave valuable insights into the strategies on service quality states served by U S West have used, as did Eileen Benner of the Idaho Public Service Commission. Whitey Thayer of the Federal Communications Commission provided background information. Staff from the 32 regulatory jurisdictions included in our telephone survey must also be thanked for talking their way through the survey and often for repeat calls. Robert Loube of the District of Columbia Public Service Commission, Darrell Baker of the Alabama Public Service Commission and Rick Reese of the Public Utilities Commission of Ohio were particularly helpful in designing the survey and providing commentary above and beyond the call of duty. (All respondents are listed in Appendix B of the report.) Finally, Deb Kriete, Chair of the NARUC Staff Subcommittee on Communications and a member of the NRRI's Research Advisory Committee (RAC), reviewed a final draft of the report on behalf of the RAC. Any errors, logical or factual, omitted or committed, are of course the responsibility of the authors.

Linda Schmidt did the extensive keyboarding, formatting, and grammar, style and spellchecking for this very complex tome. Wendy Windle prepared the figures. Dr. Francine Sevel was our in-house editor. Thanks are due to all of them and to our former colleague William Pollard, who helped get the research started.

CHAPTER 1

NEW CONCERNS FOR TELECOMMUNICATIONS SERVICE QUALITY

Up to now, Americans have enjoyed the highest quality telecommunications service in the world. State regulatory commissions have helped ensure reliable, speedy, courteous service throughout the United States. The transition underway to a competitive telecommunications industry and the accompanying trend toward price regulation present complex challenges to maintaining high-quality service. The purpose of this report is to delineate some of the newly emerging issues in telecommunications service quality and suggest broad approaches that state regulatory commissions might take in meeting the challenges.

RECENT PROBLEMS

A recent article in the *Wall Street Journal* reported that the Bell operating companies reduced their staffs by almost 130,000 jobs between 1984 and 1995, or 22.3 percent.[1] But that may be only the beginning. Competition and price regulation are encouraging staff cuts, often to the detriment of service quality:

> Some service glitches already have shown up in part because of recent cutbacks. Customer-service lines yield busy signals for hours, callers are exiled and put on hold, some customers must wait for months to get a second line installed and directory assistance inquiries can go unanswered.[2]

---

[1] Leslie Cauley, "Baby Bells Face a Tough Balancing Act: Reputation for Service Is On the Line Amid Deep Staff Cuts," *Wall Street Journal*, 4 Jan., 1996, A2.

[2] Ibid.

In Colorado and other fast-growing U S West states, installation of telephone service in 1994 sometimes took many months. Responding to this lapse, the Colorado Public Utilities Commission required the company to give bill credits in cases of installation delays and told U S West to offer customers the option of cellular service if the company could not wire an area fast enough.[3] Colorado's alternative regulatory plan builds in specific incentives for service quality using a weighted index.

In Wyoming, the Public Service Commission conducted an inquiry into U S West's service that was prompted by the company's reengineering plan, the planned sale of rural exchanges, customer service complaints and U S West employee protests. The Commission concluded,

> The facts are clear that U S West has been in a prolonged and now escalating process of withdrawing and/or dismissing its dedicated, experienced, qualified work force from Wyoming. The results have been a diminution in the company's ability to respond to requests for new services, repair and maintain its facilities, provide the extension of facilities to meet customer growth within its certified area in a timely manner and respond to and satisfy customer complaints.[4]

Ameritech's five-state region recently experienced a worrisome increase in cases where a customer reports a service problem and has to complain again later about the same difficulty. Ameritech's "repeat trouble reports" as a percentage of initial trouble reports increased more than 40 percent in two years for the region as a whole. In the third quarter of 1993, repeat troubles totaled a third of all trouble

---

[3] Colorado Public Utilities Commission, *Rules Regulating Telecommunications Service Providers and Telephone Utilities,* 4CCR 723-2 (Denver, CO: Colorado PUC, 1994).

[4] *Casper Star Tribune*, 29 Sept., 1994, 1 and 12.

reports.[5] All of the Ameritech states are now under price caps and the state regulatory commissions are monitoring service quality and enforcing standards.

In New York, Nynex faced fines for failing to meet service quality goals. New York's State Public Service Commission received 11,700 complaints about Nynex in 1993, an increase of 75 percent from 1992.[6] The price regulation plans now in effect for Rochester Telephone and Nynex include strict safeguards for service quality.

Providers who must interconnect with the public switched network also depend on getting good service. AT&T, in a presentation in the fall of 1994 before the New York PSC, complained bitterly to the Commission about the quality of New York Telephone's service: "In general, we prefer to work out such problems carrier to carrier," said a spokesman. "We are here now because in the past six to 12 months, the quality of New York Telephone's service to AT&T has deteriorated to an unprecedented degree."[7] The AT&T representative singled out the frequency of failures, expressed as a percentage of total circuits in use, and outage duration, a measure of how quickly the access provider restores service once a failure occurs, as areas of poor performance. "It is not merely that the company's service has been poor," he said. "More disturbing is that there has been a clear downward spiral."[8]

---

[5] Michigan Public Service Commission interoffice communication, Jan. 25, 1995, attachment, table entitled "Repeat Tables - Percent of Trouble Reports," based on FCC "QOS for LECs Aggregated to Holding Company Level," March 1994, unpublished Xerox.

[6] "Nynex Faces $121 million in Penalties: Regulator," *Investor's Business Daily*, 26 Feb., 1995, A 19.

[7] Harry Davidow, "Statement of AT&T," *Proceeding on Motion of the Commission to Investigate Performance Based Incentive Regulatory Plans for New York Telephone Company*, Case 92-C-0665, 1, Xerox.

[8] Ibid., 2.

COMMISSION CONCERNS

The immediate concern of state regulatory commissioners and staff responsible for quality of service provided by regulated monopolies is that preparing the way for competition may directly or indirectly lead to a decline in service quality. Downsizing is a trend, perhaps even a fad, throughout the American economy. Companies about to face rivalry are likely to be particularly concerned with cutting labor costs.

Price cap regulation encourages companies to cut costs and could, without adequate safeguards, lead to lower service quality. Traditional regulation uses the cost of the company's property and plant devoted to telephone service as the basis for deciding how much the company should earn and what prices consumers should pay. Newer forms of regulation focus on prices rather than costs to allow companies to become more efficient and better able to face competition. But a company that wants to reduce its outlays for capital and labor might be tempted to cut quality as well, and this at a time when new technologies are promising unprecedented quality improvements. In a competitive marketplace, customers have a choice of providers and can easily switch from one to another. Where competition does not develop quickly, a price cap form of regulation can lead to an essential telecommunications provider cutting service quality expenses. In the United Kingdom, price cap regulation of British Telecom was followed by a decline in service quality.[9] AT&T's service quality suffered following the adoption

The immediate concern of state regulatory commissioners and staff responsible for quality of service provided by regulated monopolies is that preparing the way for competition may directly or indirectly lead to a decline in service quality.

[9] Laura Ravozzi and David Thompson, "The Regulation of Product Quality in the Public Utilities and the Citizen's Charter," *Fiscal Studies* 13, 3 (1992): 84-85.

of price caps by the Federal Communications Commission.[10] Almost half the states are using price cap regulation. More may be expected to follow, even though the Telecommunications Act of 1996 does not mandate that states use price caps.

Service quality is of moment to commissions in less obvious ways as well. For example, the transition from a monopoly market to competition requires that consumers be willing to switch to new entrants in the local exchange market. The rates that consumers pay for telephone service and other utilities has traditionally been the most important focus of public service commissions. But evidence exists that nonprice factors are often more important than price in decisions about which local service provider to choose. A Bethesda Research Institute survey of telecommunications customers that looked at "bypassers" and "nonbypassers" found that price lagged behind other factors such as responsiveness to customer needs, technical quality of service and reputation of the provider.[11] Entrenched providers may be able to leverage customer familiarity with their name and history for competitive advantage.

Commissions are also concerned over emerging issues of technical quality, an area that has traditionally been almost entirely the purview of industry standard-setting bodies. A hands-off stance by government was well suited to the one-network, one-company, AT&T era. Today's standard-setting process is more complex, less disciplined (if not anarchic) and undemocratic, yet of tremendous importance in determining the ability of consumers to use the public switched network with ease and certitude. A judiciously increased government role in technical standard setting may well be called for. Whether or not this happens, the ability of companies to compete directly relies on the quality of access to the incumbent's network. Federal telecommunications reform legislation explicitly

---

[10] John Kwoka, "Implementing Price Caps in Telecommunications," *Journal of Policy Analysis and Management* 12 (fall 1993): 749.

[11] Walter G. Bolter, James W. McConnaughey, and Fred J. Kelsey, *Telecommunications Policy for the 1990s and Beyond* (Armonk, NY: M. E. Sharpe, 1990), 366.

provides for states to referee conflict and assure that consumers are served by interconnection agreements.

Many states have put in new quality of service standards to reflect the opportunities of advanced technologies and the changed incentives of price regulation. More than 30 jurisdictions reported to the NRRI that they have revised their quality of service standards or instituted new ones since the AT&T divestiture. Many have implemented alternative regulatory regimes that tie explicit penalties and (more rarely) rewards to service quality. Several states had dockets open at the time of this report's preparation to develop standards for service quality that are appropriate for a rapidly changing telecommunications industry.

But many questions remain. Are there emerging quality of service problems that existing commission policies and procedures are not adequately tracking and addressing? What is the appropriate role of commissions in the development of technical standards by industry? To what degree can problems of quality be left to the market to resolve? What new methods should commissions be exploring to assure service quality? We will attempt to shed some light on such issues.

Scope and Organization of the Report

Quality of service can be conceptualized in a variety of ways, from the very narrow to the extremely broad. A commission staff member asked to define quality of service might speak of installation delays, "noise on the line," and other customer service and technical problems. The academic literature in business management and economics, however, construes quality as everything that is not price. We have chosen the latter conceptualization. The regulator looking for a detailed plan for setting up a quality of service program will not find it here. Instead he or she should finish reading the report with a sense of broadened

horizons for thinking about designing explicit policies for service quality.[12] In chapter 2, we explicate the concept of service quality as a broad array of nonprice characteristics. We examine how those characteristics are affected by changing technology, the development of competition, increasing demands on interconnection posed both by technology and competition, and other factors.

In navigating the discussion in chapter 2 and throughout the report, the reader should keep in mind three key distinctions. The first is the familiar dichotomy between monopoly and competition. The second distinction is among types of networks, categorized by their degree of interconnectedness and the presence or absence of dominance by one provider. The "traditional" network was highly interconnected and was the province of one company. The system of "parallel" networks that now exists, with cable, cellular and private providers largely or entirely separate from the landline telephone network, is being succeeded by a "network of networks," where all providers of telecommunications services are interconnected. The network of networks may take the form of one provider providing the infrastructure platform to which all the others connect, which is expected to happen, at least initially. The local exchange carrier provides this "linchpin" function. Ultimately, the network of networks may evolve to an "intermeshed" form, in which no one provider is dominant.[13] The third distinction is between "economic" regulation and "protective" regulation. In economic regulation, suited to monopoly market

Throughout the report, the reader should keep in mind distinctions between:

- *Monopoly and competition*
- *The traditional network and the network of networks (linchpin or intermeshed)*
- *Economic regulation and protective regulation*

[12] Nor will the reader find reference to the large literature on "total quality management." The focus here is on assuring quality in service delivery, not a firm's internal quality control system.

[13] Phyllis Bernt, *Regulatory Implications of Alternative Network Models for the Provision of Telecommunications Services* (Columbus: The National Regulatory Research Institute, 1994).

conditions, a government agency, such as a state regulatory commission, specifies the rules under which a company can operate and the prices it may charge. In protective regulation, competitors exist but government intervention is needed to make up for market imperfections through influence over nonprice factors, such as the information available to consumers. The two types of policy are in fact intertwined. We emphasize the distinctions because a central thesis of our report is that the relative importance of economic and protective regulation, and the ways in which protective regulation is exercised, depends on the evolution of competition and the network.

With a clear definition of service quality and a grasp of the dynamics that are giving birth to new issues, we will turn in three chapters to an exploration of broad approaches to continued assurance of service quality. Chapter 3 looks at existing commission programs in protective regulation. We discuss the results of a survey of state regulatory commissions that have revised or added quality of service standards in the last ten years or so. The chapter builds on work already done by the NARUC Staff Subcommittee on Telecommunications Service Quality, which published a *Telephone Service Quality Handbook* in 1992.

Much of the quality in telecommunications service derives from technical integration that residential and business customers never see. The bulk of these efforts at standardization are undertaken by nongovernmental "voluntary standards organizations" (VSOs) whose decisions are not directly affected by the market or the government. Assuring excellent technical quality that is also seamless and transparent to the user requires numerous agreements among industry representatives working in standard-setting bodies like the Alliance for Telecommunications Industry Solutions (ATIS).

If they thought about it at all, customers would be happy with the very invisibility of the technical underpinnings that allow seamless, transparent, high-quality service in telecommunications. Nor have public service commissions been overly concerned with industry standard setting. Commissions do not

participate in ATIS, largely because the standard-setting process up to now has worked well.

But there are also forces at work that might call for greater government expertise and involvement (or at least influence) in standards setting. Chapter 4 looks at the means industry itself uses to govern technical service quality. An understanding of the strengths and weaknesses of this sort of process may be expected to help lay out areas where government intervention is appropriate and where it seems to be unnecessary. The chapter looks at customer service standards in industry as well as technical ones. Technical standards are primarily distinguishable from consumer-driven ones by the duration of their impact. Technical decisions about kinds of technology and their architectures cannot be changed in the short run, while customer service ones can.

Chapter 5 explores economic incentives, first of the marketplace and then of direct and indirect effects of regulation. Particular attention is paid to the relationship of economic regulation to service quality. We begin with an analysis of incentives under ratebase, rate-of-return regulation and then turn to the impact of price cap regulation.

In chapter 6, we analyze broad approaches to assuring telecommunications service quality. First, we briefly discuss quality of service under the intermeshed network model, having presented a linchpin model in chapter 2. Means of strengthening traditional protective regulation are discussed, including the efforts of states that regulate U S West to use regional cooperation as a tool to improve service quality. We present a minimum subscribership plan which would in essence substitute pure protective regulation for economic regulation by removing most price constraints on a regulated company and instead imposing a binding minimum constraint on the number of residential telephone subscribers. The chapter includes proposals for better informing and educating consumers on telecommunications quality, including through development of a quality labeling program, akin to that used for nutritional content of foods. Finally, the chapter suggests that

commissions take a more proactive role in industry standard setting. The report concludes with a brief recapitulation (chapter 7).

We hope the NRRI research will fill in some empty spaces in the literature on service quality for telecommunications. Professors Sanford Berg and John Lynch have pointed out that service quality is a little studied area as it relates to state regulatory concerns in telecommunications.[14] We have attempted to bring together some of the concepts, applications, and approaches that will serve commissions as they grapple with a rapidly emerging problem area.

Sixty state regulatory commissioners from 40 states and Canada gathered in Denver in 1995 in an unprecedented concerted effort to discuss the role of commissions in the year 2000. Among the judgments on which they reached broad agreement was that "attention to service quality will be of greater importance as competitive markets proliferate and financial regulation diminishes."[15] This report provides a systematic look at the problems of telecommunications quality of service and possible solutions to some of them as we move towards an era where protective regulation is a much higher proportion of the commissions' job than now.

Sixty state regulatory commissioners gathered in 1995 in an unprecedented concerted effort to discuss the role of commissions in the year 2000. Among the predictions on which they reached broad agreement was that "attention to service quality will be of greater importance as competitive markets proliferate and financial regulation diminishes."

---

[14] Sanford Berg and John G. Lynch, Jr., "The Measurement and Encouragement of Telephone Service Quality," *Telecommunications Policy* (April 1992): 211.

[15] The National Regulatory Research Institute, *Missions, Strategies and Implementation Steps for State Public Utility Commissions in the Year 2000; Proceedings of the NARUC/NRRI Commissioners Summit* (Columbus: NRRI, 1995), 4.

CHAPTER 2

DEFINING THE SERVICE QUALITY PROBLEM

"Quality" is a word often used as if it refers to a single obvious attribute, just like price. But contemplation of even the simplest commodity shows that "quality" is shorthand for a bundle of notions. Does the local woodcutter not only tell you he is selling nothing but aged hardwood, but delivers the cord you ordered on time, and you find that his wood tends to burn slowly and evenly and smell good? Availability, reliability, trust, and aesthetics are individual qualities valued even in a humble log.

If the simplest objects traded in the bourse of everyday life are imbued with various points of light that we call quality, telecommunications service must be infinitely more complex. What precisely is service quality as applied to telecommunications and how is it measured? How are different aspects of service quality affected by the transition to competition, technological developments, and other changes? How do customers differ in their requirements for quality? In the following pages, we will provide a framework and an overview of telecommunications service quality issues, such as a concern for network reliability, availability of new services, and consumer trust in telecommunications providers. The purpose of the chapter is to provide an awareness of the multiple dimensions of quality and of emerging problems.

A "Linchpin Network" Framework for Analyzing Quality of Service Issues in Telecommunications

Any single market today for telephone service from the local public switched network may be viewed in greatly simplified terms as populated by a local exchange carrier, up and coming competitors, end-use customers, and federal and state regulators. The conceptual framework depicted in figure 2-1 is important to an understanding of the types of problems that are beginning to be faced by regulatory agencies. It illustrates the sources of emerging issues, including technology, monopoly power of the dominant provider, competition, and interconnection. The framework also previews the next several chapters, which will deal with protective and economic regulatory controls on quality (chapters 3 and 5), industry controls (chapter 4), and market controls (chapter 5). The market may be thought of as a geographical one, although delimited service areas are one of the many constraints likely to break down in the near future for telecommunications services.

The conceptual framework depicted in figure 2-1 illustrates the sources of emerging issues and previews the next several chapters.

The network, too, must be considered transitional. Phyllis Bernt, analyzing the evolution of the public switched network, sees the old paradigm of telecommunications networks based on "parallel nonsubstitutable services" beginning to be replaced by a network of networks.[1] The traditional public network includes local and long distance networks with no remarkable interconnection needs since they provide different services through different technologies. The cable network is a largely separate entity. Cellular and private networks are small, and

[1] Bernt, *Regulatory Implications*. An earlier description of the concept is provided by Ithiel de Sola Pool, *Technologies of Freedom* (Cambridge, MA: Harvard University Press, 1983), 227.

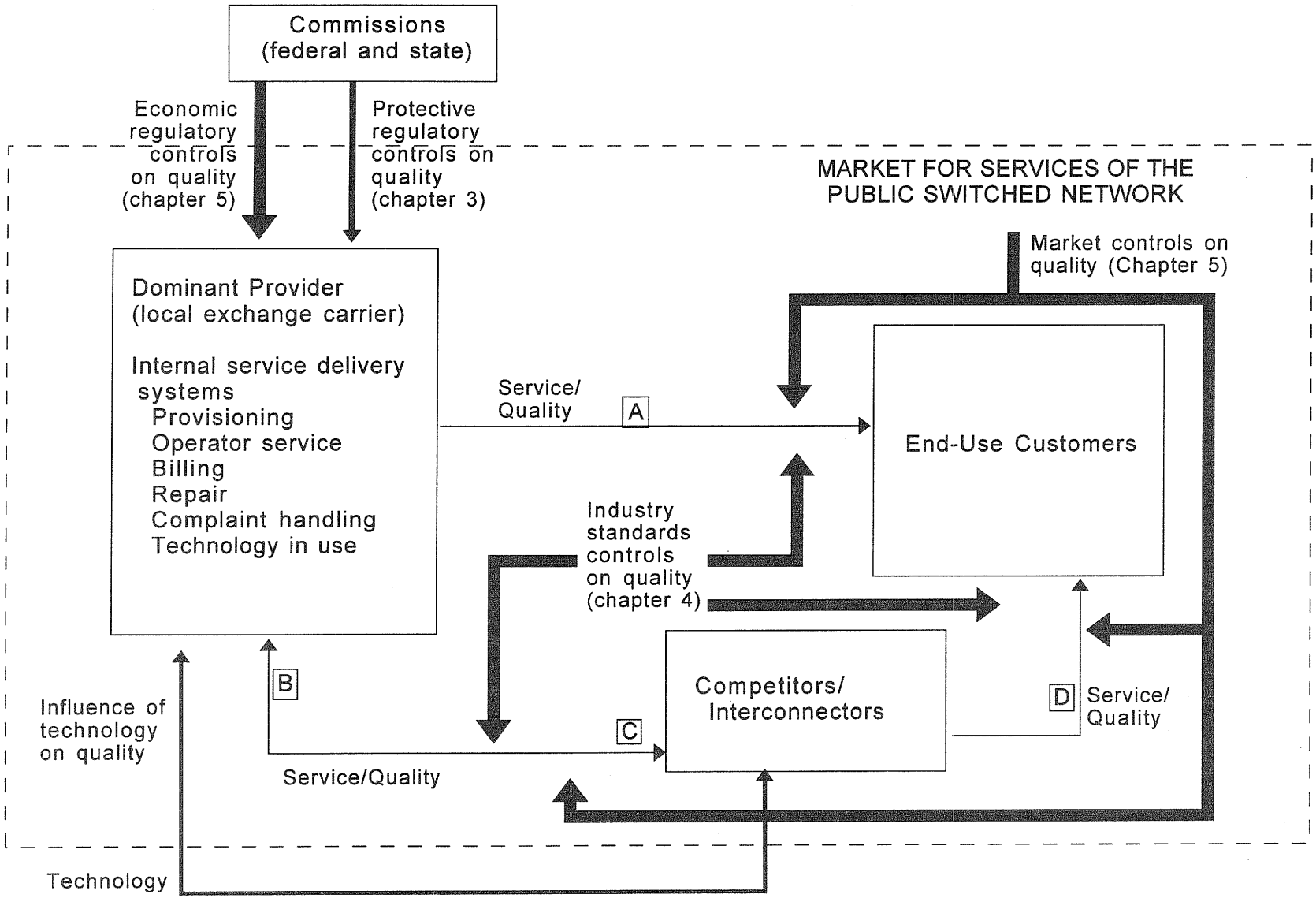

Figure 2-1. A "linchpin network" framework for the analysis of quality of service issues in telecommunications.

while the cellular networks are connected to the public one, the private networks may or may not be.

The coming network of networks may ultimately look like the intermeshed model developed by Bernt and composed of interconnected equals. We will discuss the intermeshed network and its predecessors further in chapter 6. In the meantime a linchpin model seems more likely and is consistent with figure 2-1. In the linchpin model one network provides a platform with which all the others are interconnected. The local exchange carrier, because it has the facilities already in place to make the final connection to the customer, the so-called "last mile," plays the role of the linchpin.[2] This means that the local exchange carrier provides service both to end users (businesses and residences) and to its own competitors, which include interexchange carriers, cable companies, wireless companies, competitive access providers and others that must use the linchpin to reach at least some of their customers some of the time. Thus, services with varying degrees of quality are provided at four different points in the figure–from the local exchange carrier to end users (A), from interconnectors/competitors to the local exchange company (B), from the local exchange carrier to the competitors (C), and from the competitors directly to end users (D). These end users include large businesses, small businesses and residential users, which are likely to differ in their demand for quality as well as services.

Provisioning, the technology in use (meaning the signaling, switching, and transmission infrastructure of the company), operator services, billing, repair and the handling of complaints are important internal subsystems that contribute to providing telecommunications services and the level of service quality. Figure 2-1 shows those subsystems for the local exchange carrier. Other full-service, facilities-based telecommunications providers would have to have these subsystems as well. Provisioning refers to supplying consumers telecommunications services.

---

[2] Bernt, *Regulatory Implications,* 20.

The technology in use is the hardware and software that actually provide service. Operator services refer to directory assistance, directory listings and other means of aiding customers to direct their calls. Billing includes the format of a bill as well as the process of accounting for money customers owe the company. Repair services correct malfunctions. And complaint handling refers to attention to customers' inquiries and problems.

The diagram shows several broad influences on quality in the market for services of the public switched network. The state of technology is treated here as an input and will not be a topic of extended discussion in a separate chapter of the report. The market for telecommunications services imposes controls on quality, whether the market is monopolistic or competitive. Industry standards are another principal means of assuring high quality.

Finally, federal and state agencies exert control, either intentionally or unintentionally, on the quality of service of telecommunications providers. Reagan distinguishes between economic and social regulation in the types of controls.[3] In economic regulation, an agency sets the conditions of entry and exit for industry, the rates a company may charge, the return it may earn and sets other financial constraints on the conduct of business. Economic regulation substitutes for the market and has been the primary job of commissions. Economic regulation works indirectly on quality, affecting the regulated monopoly's behavior and in turn what the customers, whether end users or competitors, actually receive in the way of quality.

Controls on price and competitive entry have traditionally been defined as "economic regulation." Government regulation of "the safety and quality of goods and services purchased, the accuracy of information provided by sellers, and the human and environmental impacts associated with production" are grouped under

---

[3] Michael D. Reagan, *Regulation: The Politics of Policy* (Boston: Little, Brown and Co., 1987), 17-18.

the classification "social regulation."[4] Social regulation (also called protective regulation) attempts to correct for those market failures that may arise even when the market is effectively competitive.[5] Environmental protection or occupational health and safety are examples. Up until now, the primary role of state regulatory commissions has been economic regulation, although they have had authority for nonfinancial oversight of public utilities as well.[6] Insofar as commissions are already regulating quality they are engaged in protective regulation, albeit in close conjunction with economic regulation. Many have set direct quality controls in the form of standards that the regulated companies are expected to meet.

Besides regulatory policies and agencies, political scientists distinguish two other policy types.[7] Redistributive policy transfers resources from one group of people to another. An example is Social Security, which transfers income from young to old. Distributive policies provide direct benefits to individuals, such as in construction of federal highways. Commission regulation has distributive and redistributive aspects, such as universal service programs and policies on economic development through

Up until now, the primary role of state regulatory commissions has been economic regulation. Insofar as commissions are already regulating quality they are engaged in protective regulation.

---

[4] H. Craig Peterson, *Business and Government,* 4th ed. (New York: Harper Collins, 1993), 404.

[5] Randall A. Ripley and Grace A. Franklin, *Policy Implementation and Bureaucracy*, 2nd ed. (Chicago: Dorsey Press, 1986), 145-176. Ripley and Franklin refer to activities we have labeled "economic regulation" as "competitive regulation," a term that will not be used here because it is confusing in the context of this report.

[6] As stated by Charles Phillips: "The second primary duty of the regulatory commission involves service and safety regulation and the overseeing of management efficiency. These aspects of regulation are extremely important since there is no such thing as a reasonable rate for service that is deficient." Charles F. Phillips, Jr., *The Regulation of Public Utilities* (Arlington, VA: Public Utilities Reports, 1993), 553.

[7] Ripley and Franklin, *Policy Implementation,* 92-115 and 177-217; and Kenneth J. Meier, *Politics and the Bureaucracy: Policymaking in the Fourth Branch of Government,* 2nd ed. (Monterey, CA: Brooks/Cole, 1987), 87-102.

infrastructure. Universal service has traditionally been billed as a distributive program, making telephone service available to every citizen. To the extent that universal service policy makes telephone service affordable to one group by charging higher rates or shifting costs to another, it is a redistributive policy. Distributive/redistributive policies have quality of service features. Penetration rates, for example, might be considered an indicator of the "quality" of availability and affordability of telephone service. For the purpose of this report the critical distinction is between economic and protective regulatory policies, with protective regulation broadly defined to include what, in another context, would be considered distributive or redistributive policies.

Service Quality as a Multidimensional Array of Characteristics

Economists have sometimes treated quality as a linear function representing the amount of service provided by a unit of a given commodity,[8] or as a scalar index representing several attributes.[9] For a given price, it is assumed that consumers prefer more quality and that quality covaries with price–common sense notions. Schmalensee has pointed out that although price and quantity can be treated as scalars, "it is far from obvious that any single mathematical representation of 'quality' can serve for

An understanding of the meaning of "quality" for any particular product or service requires an unbundling of quality attributes and elucidation of their applicability.

[8] Richard E. Kihlstrom and David Levhari, "Quality, Regulation and Efficiency," *Kyklos* 30 (1977): 215.

[9] Eytan Sheshinski, "Price, Quality and Quantity Regulation in Monopoly Situation," *Economica* 43 (May 1976): 128.

a broad spectrum of products."[10] Instead, an understanding of the meaning of "quality" for any particular product or service requires an unbundling of quality attributes and elucidation of their applicability.

Collier, in *The Service/Quality Solution*, views the many dimensions of quality as part of a "consumer benefits package."[11] The consumer benefits package is "a clearly defined set of tangible (goods-content) and intangible (service-content) attributes (features) the customer recognizes, pays for, uses or experiences."[12] Excellent service quality is "consistently meeting or exceeding customer expectations (external focus) and service delivery system performance criteria (internal focus) during all service encounters." Collier writes from the point of view of the profit-maximizing firm, for which "service/quality" (his term emphasizes that services are imbued with quality) is a means of gaining a competitive advantage. The company that can put together a more desirable consumer benefits package will have an edge on rivals. For telecommunications, service quality is a multitude of attributes that will allow providers to exploit their advantage to gain market share for their products and services, whether it is getting a consumer where he or she wants to go on the Internet faster than a rival, providing cellular service in formerly "dead" rural areas, or providing video that is full motion rather than freeze frame.

State regulatory commissions, which represent the public, have a different orientation to the consumer benefits package in telecommunications than the firm attempting to maximize profits. For their purposes, the package is made up of the array of characteristics that contribute to meeting or exceeding consumer

---

[10] Richard Schmalensee, "Market Structure, Durability and Quality: A Selective Survey," *Economic Inquiry* XVII (April 1979): 177.

[11] David A. Collier, *The Service/Quality Solution: Using Service Management to Gain Competitive Advantage,* (Milwaukee, WI: ASQC Quality Press, 1994), 167.

[12] Ibid.

expectations of the public switched network, whether the network is based on a central platform or is formed by more or less equal interconnecting systems. The commission's view of delivery system performance (internal service criteria) is also different from the firm's. The question here is how much oversight of internal functions is necessary to achieve direct consumer benefits. Avoiding micromanagement while assuring that external criteria are met has always been a sticky regulatory issue and is probably more so under price cap regulation.

Dimensions of Quality

What are the important characteristics of the telecommunications consumer benefits package? Garvin identifies qualities that apply across the board to many industries,[13] as do the developers of the SERVQUAL index.[14] Richters and Dvorak and Noam identify quality criteria specifically for telecommunications.[15] Table 2-1 shows the service quality criteria identified by these authors. Their approaches will be discussed here as the basis for a list of quality of service characteristics suitable for the analysis in this report.

---

[13] David A. Garvin, "Competing on the Eight Dimensions of Quality," *Harvard Business Review* 87, no. 6 (1987): 101-109.

[14] Collier, *The Service/Quality Solution*, 170, citing R. C. Lewis and B. H. Booms, "The Marketing Aspects of Service Quality," in *Energy Perspectives on Service Marketing*, ed. L. L. Berry (Chicago: American Marketing Association, 1983), 99-104; V. A. Zeithaml, A. Parasuraman, and L. L. Berry, *Delivering Quality Service* (New York: The Free Press, 1990), 24-26; and L. L. Berry and A. Parasuraman, *Marketing Services* (New York: The Free Press, 1991).

[15] John S. Richters and Charles A. Dvorak, "A Framework for Defining the Quality of Communications Services," *IEEE Communications Magazine* (October 1988): 19-23; Eli Noam, testimony to the New York Public Service Commission, Case 28961, Fifth Stage. Undated Xerox.

TABLE 2-1
SERVICE QUALITY CRITERIA IDENTIFIED BY VARIOUS AUTHORS

Garvin[a] (general application)		SERVQUAL[b] (general application)		Richters and Dvorak[c] (telecommunications)		Noam[d] (telecommunications)
Criterion	**Definition**	**Criterion**	**Definition**	**Criterion**	**Definition**	**Criterion**
Performance	Relates to a product's primary operating characteristics	Tangibles	Appearance of physical facilities and presence of up-to-date equipment, for example	Availability	The accessibility of a communications function, including rapid recovery from disasters causing service interruptions	Availability
Features	"Bells and whistles" of products and services, characteristics which supplement their basic functioning	Reliability	Dependability (for example, in providing services at the time promised)	Reliability	Dependability or sustainability of a communications function	Reliability
Reliability	The probability of a product malfunctioning or failing within a specified time period	Responsive-ness	Promptness and willingness to provide service	Security	The confidentiality of customer information, and protection against fraudulent charges and privacy invasions	Security

TABLE 2-1 (Cont.)
SERVICE QUALITY CRITERIA IDENTIFIED BY VARIOUS AUTHORS

Garvin[a] (general application)		SERVQUAL[b] (general application)		Richters and Dvorak[c] (telecommunications)		Noam[d] (telecommunications)
Criterion	**Definition**	**Criterion**	**Definition**	**Criterion**	**Definition**	**Criterion**
Serviceability	Speed, courtesy, competence and ease of repair	Assurance	Knowledge and courtesy of employees and their ability to convey trust and confidence	Accuracy	A measure of the correctness or fidelity–freedom from errors and distortion–in performing a communications function	Accuracy
Aesthetics	How a product looks, feels, sounds, tastes, or smells	Empathy	Caring, individual attention the firm provides its customers	–	–	Responsiveness
Perceived quality	inferences of the customer, based on tangible and intangible aspects of the product, related to reputation of firm	–	–	–	–	Courtesy

– = No further criteria identified by cited authors.

Source: [a] Garvin, "Competing on the Eight Dimensions of Quality."
[b] Zeithaml, Parasuraman, and Berry, "Delivering Quality Service."
[c] Richters and Dvorak, "A Framework for Defining the Quality of Communications Services."
[d] Eli M. Noam, "The Quality of Regulation in Regulating Quality: A Proposal for an Integrated Incentive Approach to Telephone Service Performance," in *Price Caps and Incentive Regulation in Telecommunications*, ed. Michael Einhorn (Boston: Kluwer Academic Publishers, 1991) 168-189.

Garvin proposed eight dimensions of quality to serve as a framework for strategic analysis by U.S. corporations, suggesting that the dimensions can be used by a company to distinguish its products in quality niches.[16] Although Garvin claims that his categorization is applicable to less tangible products, most of the characteristics he identifies are more easily associated with goods than services, and thus not all of them are directly applicable to external service criteria in telecommunications, nor to regulatory agency interests.

Berry, Parasuraman and Zeithaml are the creators of SERVQUAL, an instrument for the measurement of customer perceptions of service quality. Their five criteria listed in Table 2-1 are consolidated from a list of ten dimensions in their earlier research. "Assurance" includes criteria that had earlier been distinguished as competence, courtesy, credibility, and security.[17] The authors attempted to refine their dimensions through factor analyses based on surveys of four different types of organizations–a dental school patient clinic, a business school placement center, a tire store and an acute care hospital. The authors found support for most of the dimensions, but suggested that their categories were "not so generic that users of these scales should not add items on new factors they believe are important in the quality equation."[18]

Richters and Dvorak developed service quality criteria that customers use to judge the quality of communications functions. Their work is thus directly applicable to the task of this report. Eli Noam, who testified on the establishment of alternative regulation of New York Telephone to the New York Public Service Commission, cited the criteria used by Richters and Dvorak, adding responsiveness

---

[16] Garvin, "Competing on the Eight Dimensions of Quality," 296.

[17] Zeithaml, Parasuraman, and Berry, "Delivering Quality Service."

[18] James A. Carman, "Consumer Perceptions of Service Quality: An Assessment of the SERVQUAL Dimensions," *Journal of Retailing* 66, no. 1 (spring 1990): 41.

and courtesy to their list.[19] Richters and Dvorak listed communications functions, combined performance criteria and functions in a matrix, and assigned appropriate performance parameters to cells in the matrix (Table 2-2).

We may identify major aspects of service quality that draw upon but do not fully duplicate any of the sources cited above. Richters' and Dvorak's categories of availability, reliability, flexibility, security and simplicity will be used here. Speed may be viewed as for the most part a subset of availability and accuracy a subset of reliability. To the Richters and Dvorak list we have added assurance. Table 2-3 is our adaptation Table 2-2. For each internal service delivery subsystem of concern to state regulatory commissions, the table suggests sample quality of service indicators. Similar tables could be developed for other services such as data services. Richters and Dvorak, for example, delineated criteria and functions for data services in a similar table. The indicators mentioned here and below are not meant to comprise an exhaustive list. Nor does the table specify measures operationally–for example, number or percentages of errors to be counted within a particular time frame.

Major aspects of service quality are:

- Availability
- Reliability
- Security
- Flexibility/choice
- Simplicity
- Assurance

RELIABILITY/ DEPENDABILITY

Reliability is the bedrock parameter of service quality, subsuming all other technical attributes of a telecommunications system. As defined by the telecommunications engineer, reliability is the probability that a system will be in

[19] Noam, "The Quality of Regulation," 168.

TABLE 2-2

RICHTERS' AND DVORAK'S QUALITY OF SERVICE FRAMEWORK: Parameters for Voice Over the Public Switched Telecommunications Network

Internal Service Delivery System	Speed	Accuracy	Availability	Reliability	Security	Simplicity	Flexibility
Technical sales planning	Response time	Percent correct information	Hours staff can be accessed	Percent optimal information	Confidentiality	Ease of contact	Options and alternatives
Provisioning	Time to deliver	Percent correct	Hours staff can be accessed	Percent optimal	Confidentiality	Ease of contact	Options and alternatives
Technical quality • Connection establishment	Dial tone delay Post-dialing delay	Percent wrong number (due to network)	Percent blocked Percent no network response	Percent outage (due to network failures)	Percent bridged connections	Number of digits dialed Understandable announcements	Number of alternate routes
• User information transfer	Propagation delay	Transmission quality	Dropouts	Percent cutoffs	Intelligible crosstalk	–	–
• Connection release	Time to release	Percent correct	–	–	–	–	–
Billing	Percent late	Percent correct	Frequency	–	Percent fraud	Understandable	Alternate programs
Network service management by customer	–	–	–	–	–	–	–
Repair	Time to repair	Percent correct	Hours staff can be accessed	–	Confidentiality	Ease of contact	Options
Technical support	Time to respond	Document quality: knowledge level	Hours staff can be accessed	–	Confidentiality	Ease of contact	Options

– = No parameters identified.

Source: Richters and Dvorak, "A Framework for Defining the Quality of Communications Services," 19.

TABLE 2-3
SERVICE QUALITY CRITERIA, FUNCTIONS, AND MEASURES FOR BASIC TELEPHONE SERVICE TODAY

Service Quality Criteria	Definition	Functions					
		Provisioning	Technology in Use	Operator Services	Billing	Repair	Complaint Handling
Availability	Access to the public switched network	Business office answer time; time until installation; availability of new numbers, location of pay telephones	Dial tone delay; calls delivered to 911 authority	Inclusiveness of listings; operator answer time; directory assistance answer time	Monthly bills	Repair service answer time; time to repair; appointments kept	Speed of access to complaint process
Reliability	Dependability	Installations done correctly; appointments kept; failure-free operation	Central office maintenance; transmission performance; call completions; functioning of pay telephones; backup power; outages	Accuracy	Accuracy	Repeat trouble reports	Complaints handled correctly
Security	Confidentiality of customer information, protection against fraud, privacy	Confidentiality	Lack of intelligible crosstalk	Confidentiality of unlisted numbers	Confidentiality	Confidentiality	Confidentiality
Flexibility/Choice	Ability to offer, adapt, or customize a function to meet individual needs	Options offered	Ability to support options offered	Ability to offer options	Accurate, informative breakdown of charges	Scheduling flexibility	Choice of electronic or human complaint representative
Simplicity	Ease of understanding or performing a communications function	Ease of choosing among options	Number of digits dialed; adequacy of intercept services	Understandable	Understandable	Ease of contact	Ease of contacting, understanding
Assurance	Competence and credibility	Customer beliefs	Customer beliefs	Customer beliefs	Customer beliefs	Customer beliefs	Customer beliefs

Source: Authors' construct based on Richters and Dvorak.

service performing a specific function in a given environment at a later time. The expected life of a device or its mean time between failures can be derived from this probability figure. Outages, measured at a variety of points, deny customers access to the network. How well a central office is maintained is an indicator public service commissions have used for reliability. Call completions, the functioning of pay telephones, transmission performance, and availability of backup power are others. Reliability has a broader meaning to the non-engineer. For the provisioning function of the telephone service provider, whether installations are done correctly is a measure of dependability, as are the number or percentage of appointments kept. The accuracy of operator services may be considered an indicator of reliability of this function, as well as such factors as inclusiveness of listings, time before the operator answers, and whether everybody who is supposed to be in a directory is in fact listed. Repeat trouble reports are an indicator of undependable repair service. Accuracy of operator services, billing and complaint handling may all be considered measures of reliability or dependability.

AVAILABILITY

Availability is a necessary stepping stone to the use of any product or service. Hedvall and Paltschik, writing generally, distinguish only two underlying quality dimensions–the ability to serve and access.[20] Access to the public switched network, it may be argued, is the quintessential quality in telephony, certainly insofar as the publicness of that network is concerned. The principle of universal service is one of availability, and penetration rates for telephone service are a widely used measure of the degree to which services are ubiquitous, although commissions have not traditionally viewed this as an indicator of service quality.

---

[20] Maj-Britt Hedvall and Mikael Paltschik, "Intrinsic Service Quality Determinants for Pharmacy Customers," *International Journal of Service Industry Management* 2, no. 2 (1991): 38-48; cited in Collier, *The Service/Quality Solution,* 171.

Turning to more typical issues of availability and beginning with the technology in use, in an engineering sense, availability is the complement of reliability. Except for how often a device fails and for how long, the device can be assumed to be operational (available). When a customer's telephone is out of service, he or she considers it unavailable. The length of time a customer is without service (time to repair) may be considered an availability measure, while the number and percent of outages are measures of reliability. Dial tone delays and calls not delivered to emergency (911) authorities may be classified as technical availability issues. For provisioning, the time until installation is a critical element in making the public switched network available to a user. Other measures of how well basic access is being provided include how quickly the business office responds to installation requests, availability of new numbers and access to pay telephone service. Access to the complaint process indicates the availability of that function.

SECURITY

Privacy is a vital quality of telephone service that customers assume they are purchasing as part of the consumer benefits package. Intelligible crosstalk on a single-party line is a basic, traditional technical issue related to security. The confidentiality of unlisted numbers is another.

Subscribers have expectations of privacy ranging from confidentiality of financial matters to anonymity. Directory services and caller identification (caller ID) must be both accurate and consistent with the privacy wishes of the subscriber. Some transactions subject to subscriber confidentiality and perhaps quality of service standards are:

- unpublished numbers within printed directories
- unlisted numbers within directory assistance
- blocking numbers from caller ID (local)

- blocking numbers from automatic number identification (long distance)
- intercepts ("this number has been changed to...")
- numbers within marketing organization
- numbers "in the open" in toll call transactions
- insecure billing process (including mail)

FLEXIBILITY/CHOICE

This criterion has to do with the ability of the service provider to offer services that fit customer requirements. It includes both offering the customer alternatives and efficiently tailoring the alternatives to customer needs. Table 2-3 is confined to considering today's basic telephone service, but even here there are choices. These include small office and home office customizations through multiple lines, custom calling features and directory listing options. The accurate communication and installation of the options desired by the customer are an essential part of the provisioning function, since the technology in use by the company must be able to support those options. Operator services also should be able to be flexible and provide choice, such as in access to interexchange operators or to more than one language. Accurate, informative breakdowns of billing charges aid the customer in choosing the options that are right for him or her. In the repair services function, the ability of the company to meet the customers' parameters for scheduling repairs that require the customer to be home is a quality of service indicator.

SIMPLICITY

All other things being equal, a customer is likely to prefer a service that is easy to install, operate and maintain. The number of digits a customer has to dial is a measure of the simplicity of the technical functions of the network. The

adequacy of intercept services, such as letting the customer know automatically that a number has been changed, may be viewed as measures of simplicity. Ease of choosing among options is an indicator of simplicity for the provisioning function. Operator services, billing, and complaint handling processes all need to be understandable to the customer using those company functions. Simplicity is a particularly important aspect of complaint handling, since many complaints turn out to be at least in part misunderstandings. Providing clear information to the customer as part of the complaint resolution process can be looked at as a measure of the ease of use of telecommunications services. Ease of contact is an indicator of simplicity in dealing with repair and complaint handling functions.

ASSURANCE

Assurance is a subjective but critical component of quality. The measures of assurance suggested in Table 2-3 are all based on customers' own assessments of the service they are receiving. Customer beliefs about the competence and credibility of the company may be assessed through customer satisfaction surveys, asking, for example, how well they believe the company conducts repair service. Other beliefs to be assessed and evaluated include whether the customer has faith in the technical quality, provisioning and other functions of the provider. Much of this dimension of quality has to do with expectations. For example, customers in one service area may accept without question dial tone delays that customers in another area are not used to and will not tolerate.

EMERGING ISSUES

The technological and financial revolution proceeding apace in the telecommunications industry is bound to have an impact on how service quality is defined and the form and impact of quality deficiencies. Table 2-4 broadly identifies many of the new issues that may face companies, their customers and state regulators. First and ultimately most influential, since they underly all other changes, are those brought about by innovations in technology. The process of moving from what has been primarily a monopolistic market structure to one based on competition will change the shape of quality and its uses by telecommunications providers attempting to gain a competitive advantage. And interconnection issues, in a broad sense, will also affect and be affected by quality concerns.

CHANGES IN TECHNOLOGY

The revolution in telecommunications is a welcome explosion in choice and flexibility. In other words, by definition, quality will be improved, although not necessarily across all quality dimensions. New capabilities are often accompanied by expectations of greater reliability. As residential and small business telecommunications users shift from plain old telephone service (POTS) to seamless, ubiquitous broadband services provided from a digital platform, the technical perspective of quality will shift as well. Each new technology introduces new variables, which often involve industry standards or new service agreements. These emerging products have more detailed if not more rigorous requirements for technical quality.

The revolution in telecommunications is a welcome explosion in choice and flexibility. By definition, quality will be improved, although not necessarily across all quality dimensions.

TABLE 2-4
EMERGING ISSUES IN TELECOMMUNICATIONS SERVICE QUALITY

Criterion	Technological Issues	Market Structure Issues		Interconnection Issues
		Monopoly	Competition	
Availability	Differential access to new technologies	Delays in installation and repairs, universal service threats	Inclusiveness of directory listings; problems of wireless access to 911	Nondiscriminatory mutual access to networks and customers, data bases, pools of numbers, and rights of way
Reliability	Potential for reliability; difficulty of repairing fiber	Reduced reliability of provisioning, repair, and complaint handling	Data base reliability	Interoperability; weakest link problem
Security	New services, capabilities for locating and identifying customers	Confidentiality of customer information	Lack of new provider knowledge, commitment to privacy needs	Sharing of customer information
Flexibility/Choice	Rapidly expanding options and combination of options	Aggressive marketing of options; misleading packaging of options	Problems of number portability, rapidly expanding choice of providers	Open network architecture issues
Simplicity	Understanding how a system works and fails	Incorrect responses to consumer demand for simplicity/complexity	Number of digits dialed, understanding choices of providers, understanding responsibilities of providers	Difficulty of creating seamless interfaces for multiple providers and services
Assurance	Track record of new providers	Consolidated service centers; recorded messages to handle complaints	Misleading quality claims, advantages to incumbent; unauthorized changes in providers ("slamming")	Concern whether all combinations of providers can successfully complete calls

Source: Author's construct.

FLEXIBILITY/CHOICE

Table 2-5 outlines four broad categories of telecommunications product and service offerings beyond voice grade, low-speed communications provided over copper wire through analog switches and provided to both commercial and residential users. A generational change in telephone central office switching equipment has not only made possible additional features for basic telephone service but enabled entirely new services. Each of these new features and services has measurable quality criteria.

Dedicated digital circuits have been available to large and small business customers to connect branch offices, often bypassing the local carrier. Companies have used these leased circuits to establish private networks for both voice and data. Leased lines are specified domestically using the T-1 circuit (1.54 megabits per second, or 24 simultaneous trunks) as the basic unit. Public network interconnection is available for use by residential as well as commercial users.

Spurred by corporate networks and home access to the Internet, Integrated Services Digital Networking (ISDN) is increasing. Service revenues for ISDN in 1995 were expected to reach $1 billion, with PacBell planning to connect one million ISDN customers within two years.[21] ISDN permits dialed ("switched") connections on demand, as opposed to dedicated or leased circuits. ISDN provides the infrastructure for video teleconferencing by business customers and for computer networking. Both of these applications introduce standards and service issues of their own.

Broadband services, such as Asynchronous Transfer Mode, are being developed to transport a variety of services (full motion video broadcasts, interactive multimedia, voice telephony, and computer networking) simultaneously at high speed over the same medium. Unlike the existing telephone system based on circuit connections, broadband networks treat all communications as series of

---

[21] "PacBell to Launch Massive ISDN Push," *PC Week,* 3 April, 1995, 1.

TABLE 2-5

PLATFORMS FOR EXISTING AND DEVELOPING TECHNOLOGIES AND SERVICES

Technological platform	Service Capabilities
Analog copper subscriber loop	Dialed voice connections (POTS) Dedicated analog connections (for example, 3002 and multidrop) Low-speed data communications Subscriber features
Dedicated digital circuits, including T-1	Private voice networks Private data networks, including frame relay Point-to-point video teleconferencing
Switched digital service, including ISDN	Dialed voice connections High-speed data communications (on demand) - remote network access including Internet Video teleconferencing Remote broadcast audio
Broadband network services (proposed)	Dialed voice connections Customized data communications Video teleconferencing Video/Audio distribution (that is, broadcasting) Interactive multimedia computer systems
Advanced wireless	Agile/mobile voice and data communications

Note: Common configurations for existing and proposed telecommunications services. Some services, such as video teleconferencing, may be provided using different configurations.

Source: Author's construct.

data packets. Communications services in broadband networks will be customized, introducing quality issues for both the end-user service and the underlying network. Video/audio conferencing and interactive computer systems will be used by both residential and business customers.

The leading central office digital switches, AT&T 5E and Nortel (Northern Telecom) NTX, essentially are computers, the capabilities of which can be increased by adding features in software. Recent product literature from Nortel identified nearly 50 optional features available to residential and small-business customers in the categories of convenience, voice messaging, and calling number identification.[22]

Assessing the quality of software-based subscriber services requires a new perspective. Software, unlike electrical or mechanical devices, does not fail due to age or use; rather, software failures are generally latent errors of design or are the result of incomplete testing. There are three phases of a software product's life-cycle susceptible to error:

- Specification and design: was the software intended to perform the appropriate telecommunications function in the proper way?
- Configuration: are appropriate hardware, software, and data resources available in the central office?
- Operation: are subscriber and administrative transactions handled adequately?

---

[22] Northern Telecom Inc., *Residential Services Software Dependencies* (Nashville, TN: Northern Telecom Inc., December 1990), 1-3.

Specification and design are accomplished at the outset so that errors are assumed to be designed out. Over five years ago, two unrelated incidents of design flaws affected all 114 switches in the AT&T network.[23] In the first instance, an error in new signaling software introduced a mutual "deadlock" among switches. In the second, a subtle change in the timing of interswitch communication uncovered a programming bug whose "workaround" required blocking five million calls in a nine-hour period.[24]

Software configuration problems may be illustrated by the case of voice mail, a software system that requires temporary and permanent storage and a number of "ports" into the telephone network. Often the levels of required resources for appropriate configuration of voice mail cannot be predicted adequately. The result may be an underequipped voice mail system, which presents itself as a failure to some and as degraded performance to others. Other optional central office features may be less resource-intense, but require significant setup effort to operate properly.

Operational quality issues may be best exemplified by Calling Number ID (that is, caller ID, CNID). The effects of failure of this service are arguably the most severe among the new switch features. Product literature lists at least six optional CNID features, in addition to 911 services. Blocking a number when dialing out, originating a trace, and selectively rejecting calls are features that depend on correct system administration. Moreover, the data base of dial numbers must be accurate without exception.

Newer technologies are making it possible for the network to be more reliable, but not across the board.

---

[23] John C. Wohlstetter, "Gigabits, Gateways, and Gatekeepers: Reliability, Technology, and Policy," in *Quality and Reliability of Telecommunications Infrastructure,* ed. William Lehr (Mahwah, NJ: Lawrence Erlbaum Associates, 1995), 225.

[24] A workaround is a change in operating procedures to mitigate the effects of a system flaw.

RELIABILITY

Newer technologies are making it possible for the network to be more reliable. Bell Atlantic and AT&T have touted the reliability of their networks, competing for advantage on the basis of quality. Fiber optic cable is exceedingly reliable. Fiber communication is all digital, which reduces most transmission errors and facilitates correction of the rest.

Newer technologies do not bring with them greater reliability across the board, however. For example, a single fiber optic cut can cause a significant outage and repairs can take longer than with copper. Network design can minimize that risk. The national AT&T network "fabric" has recently been upgraded to include a mesh of redundant fiber links between its facilities. Good practice in metropolitan areas is to establish a "self-healing" fiber ring to connect local central offices as well as alternative routing.

Coaxial cable service today is less reliable than wireline telephone service. One cable company representative, pointing out that when you attempt to dial 911, the call must go through every time, estimated that increasing network reliability from 99.5 percent to 99.99 percent will require cable companies to almost double their investment in facilities.[25]

Residential computer use is changing both expectations and parameters of reliability. Increasing residential computer use is significantly raising awareness of telecommunications quality of service. While human conversation can adapt to degraded or interrupted service, computer devices cannot. A very good indirect measure of circuit quality is the maximum speed at which a computer modem can operate, augmented by the number of calls required to sustain communication. Often the techniques used (for example, repeaters) to improve the performance of voice communications (especially in rural areas) have been detrimental to data

---

[25] John Porter, President of Warner Cable–Columbus Division, speaking to a CAST roundtable, 10 Feb., 1995; *Cast Calendar and Newsletter*, no. 2 (spring 1995): 3.

communications. Thus, bringing advanced telecommunications services to rural areas may hinder the maintenance of traditional levels of reliability for voice grade service.

MARKET STRUCTURE

State regulatory commissioners and staff have been concerned that recent problems in the provisioning, repair, and complaint handling by the regulated incumbent providers are due at least in part to efforts by the companies to prepare for competition. They fear that monopoly customers are being allowed to languish while the companies redirect their limited resources to invest in new services and compete in new geographic territories. Changes made in the name of efficiency, like consolidation of service in company headquarters may make it more difficult to give flexible understandable responses to captive customers.

Higher quality as well as lower prices are promised by the transition to a competitive market structure.

Commissions have longer term concerns as well. Higher quality as well as lower prices are promised by the transition to a competitive market structure. Along the way, however, there are problems to be resolved, such as assuring local number portability and making sure all consumers' numbers are in telephone directories and data bases, regardless of their providers. In terms of figure 2-1, the quality relationships to be examined are those between the local exchange carrier and end-use customers and between competitors and end-use customers.

Naturally, new competitors to the local exchange carriers will target areas for new services that promise the highest profit. Yet, these new services will have to be introduced over time, so that some customers may see services much later than others. In this highly competitive era, in which access to high-quality and low-cost services is important to individuals and businesses, introducing a service late may be just as bad as not introducing it at all. High-cost and low-profit areas are likely

to see stagnation or even degradation of quality. In some areas, new services may never be provided at all. The likelihood of different geographic availability of technologies is heavily bound up with the universal service issue.

A growing tension between carriers' needs to share information and subscribers' desires for privacy and security is another quality issue. Carriers, especially in the cellular industry, must prevent losses due to fraud and enhance billing processes. Both wireless and wireline carriers are preparing to authenticate each caller using a data base before making a connection, thus making specific data available nationally at all times. The authentication process for a toll call, for instance, might prevent a call from being completed if the telephone set is stolen or the account is in arrears.

The newly competitive world is likely to be more complicated for consumers. Even today, customers face difficulties in assigning responsibility for telecommunications malfunctions. Inside wire is not the province of the local exchange company, for example, unless the customer has a maintenance contract. When there are multiple providers of telecommunications service it may be even more difficult than now to assign responsibility for a service problem.

While assurance is a valuable aspect of quality, it can work against the development of viable competition. From the firm's point of view, consumer trust gives a competitive advantage and in a fully competitive setting is something to be striven for. If a company has been a monopoly, however, new entrants have to earn their own credibility and thus may be at a disadvantage. AT&T has been able to use assurance as one means of keeping customers from changing carriers. Even 11 years after divestiture, AT&T has almost 60 percent of the long distance customers.

A Bethesda Research Institute study of "bypassers" and "nonbypassers" found that most customers in Pennsylvania and the District of Columbia would tend to continue to subscribe to the Bell company even if its prices were 10 percent

higher than an alternative.[26] Customer loyalty, based on perceived quality, is a hard thing to change.[27] The study concluded that the importance of customer loyalty and other nonprice factors suggests "the market dominance currently enjoyed by local exchange carriers, particularly the Bell entities, can be largely preserved through carrier attentiveness to the service and feature needs of their customers." Accelerating the introduction of fiber optics into the local loop and deploying ISDN thus is "a potent market strategy" for positioning the incumbents for competition.

INTERCONNECTION

Network structure and relationships are as much of an influence on quality as market structure. Availability in an era of competition comprises accessibility for competitors to each other's networks, as well as availability of services to end-use customers. Reciprocal access to customers and data bases, as well as adequate pools of telephone numbers, will be essential to the development of robust competition and ubiquitous service. In terms of figure 2-1, the issues raised here are of changes in the quality that the incumbent carrier provides its competitors as interconnection customers and vice versa.

Network structure and relationships are as much of an influence on quality as market structure.

Under the linchpin model described above, the local exchange company is still the central provider of service. It has "carrier of last resort" responsibilities, and, in return, provides equal access to all customers. Through the rules imposed on the "linchpin" carrier, regulators can continue to affect policy throughout the

---

[26] Bolter, McConnaughey, and Kelsey. *Telecommunications Policy*, 366.

[27] The loyalty could be founded in part on customers' lack of knowledge and fear that they will not be able to learn enough about alternatives to be able to compare them, at least within a reasonable time.

rest of the telecommunications industry. Perhaps with more time, as customers become less reliant on the dominant local exchange carrier, more of them will have direct access to the public switched network through an alternative provider. Under an intermeshed network, all providers of services interconnect with one another without the necessity of working through the incumbent carrier. Under both approaches, competition must be assured by enforcing interconnection rules, reciprocity agreements, rules against market dominance, clear service standards, and symmetrical regulation across networks so that no industry is economically handicapped.

Several questions emerge for quality of service as the more precise contours of the network-of-networks paradigm emerge. The central tenet in this paradigm is that competition will ensure quality of service. Put another way, customers are protected by being allowed to choose service providers who give the best level of service. For this to work (under both scenarios) interconnection and specific standards of service and performance would need to be established by contractual agreement or administrative rule. It is clear that interconnection rules will be a central issue in regulatory and courtroom battles even after robust competition takes hold. What is less clear is the degree to which interconnection will remain an issue as new technologies and new service providers appear, thereby destabilizing the "playing field" and forcing further reconsideration of interconnection rules.

An Example of Emerging Service Quality Problems: Integrated Services Digital Networking

The case of ISDN provides an interesting example of the problems in moving from a plain old telephone service paradigm to a linchpin network-of-networks model, and finally to an "intermeshed model." In the transition from an analog to a digitally based system of communications, ISDN will probably be the first digital service widely used by consumers and small businesses. As such, it provides the

possibility for interconnecting many services and service providers with their customers. As the first digital service utilized by all classes of customers, it will be an interesting test case for later, more powerful, more complex digital services that involve significantly more human and financial investment. If we can understand some of the quality of service issues surrounding ISDN, perhaps it will shed light on some of the harder questions underlying the introduction of the broadband technologies central to the fuller realization of the network-of-networks paradigm. ISDN represents the maximum utilization of the existing investment in the two pairs of copper wires in the local loop. Any increases in the ability to send more digital information will require investment in new physical plant.

The ISDN basic rate interface is comprised of two 64 kilobit-per-second (kbps) "bearer" channels and a third digital channel (16 kbps) for signaling and control. This represents a four-fold increase over the current modem technology (24.8 kbps) required to send data over analog lines. If a customer decided to use both bearer channels for data transmission, the amount of information would be 128 kbps (again, as compared to the 24.8 kbps at which analog lines using modems can deliver data). While this is an improvement over analog lines, it is still a small fraction of the capacity involved with transmitting a broadcast video channel. For people who want better access to the Internet and to do videoconferencing, ISDN represents a significant improvement. ISDN, however, is a temporary solution if the goal is to have "video dialtone."

If we can understand some of the quality of service issues surrounding ISDN, perhaps it will shed light on some of the harder questions underlying the introduction of the broadband technologies central to the fuller realization of the network-of-networks paradigm.

Since its 1986 introduction, ISDN has been installed at many residential and small business customer sites. The geographical distribution of initial installations is not uniform, since ISDN is not available in many areas (such as New York City). But some preliminary information on service quality issues has already surfaced.

The initial issues involve compatibility and interconnection of the various switches and consumer equipment; the new responsibilities for the consumer to select, configure, and power their equipment; installation; and finally, problem troubleshooting.

To recap, the network-of-networks paradigm, as distinguished from basic telephone service, implies a variety of providers and a high degree of customer choice and control. While in the abstract these principles can argue for maximum innovation and economic efficiency, some of the early problems with implementing ISDN are due, in fact, to some of the basic assumptions underlying the network-of-networks paradigm.

One "constant" in plain old telephone service is electric power. If there is an electric blackout, the telephone continues to operate because it carries its own power system. With ISDN, responsibility for powering customer premises equipment rests with the consumer. While this assumption is clearly within the design specifications for the system, the quality of service still may be perceived to suffer since it is very much dependent on expectations, not unlike the expectation that citizens can always hear a dial tone even in a disaster. While regulatory agencies and telephone companies can easily say that it is now the customer's responsibility when there is a problem, it is doubtful that this will leave the consumer feeling that an agency or provider has given high-quality service when telephone service (and possibly access to emergency service) goes out along with the lights.

Another issue in the implementation of ISDN is compatibility among and between the many equipment and service providers. As mentioned above, this will be a central issue in working out the details of implementing the network-of-networks paradigm. In part, this is a question of developing and implementing standards, but it also involves the coordination of the many service providers in a network of networks.

As for standards, much effort and success has been obtained in finally achieving a "national" ISDN standard. Although ISDN has been technically feasible for a long time, part of the reason it has not been used more widely is because of the many incompatible standards, or ISDN "islands." But while there may now be convergence on agreement of standards, their implementation is still needed. ISDN providers might agree on the standards, but it takes time, money, and expertise actually to implement new standards and software upgrades as they are developed.

While the old model implies one service provider providing one service, ISDN certainly involves the "layering" of many services, so that the success of one software or service is dependent on more fundamental services (this is analogous to compatibility between computers, operating systems, and application software). These more fundamental services must, by definition, be more reliable but they also must be able to work together technically. This makes for a far more complicated engineering problem than when there is one provider for one service. It also implies that customers and contract lawyers must be very clear about the terms under which the various layered services are provided. If not, consumers of those services will have problems figuring out which service provider is responsible for an ISDN problem. Consumers can find themselves feeling like tennis balls bouncing from one provider to another in trying to solve a problem. It is not unlike the situation where the tire manufacturer blames the automobile repair shop and the auto mechanic says that the customer should contact the tire manufacturer.

Ultimately, at some level of complexity, the problem becomes unsolvable for consumers both because: (1) they have very little technical background and time to be able to sort through these claims; and (2) even if they did, the problem in essence is both an alignment and a tire problem. The many kinds of tires and autos out there have to somehow work together in the same way that multiple providers of telecommunications services and equipment need to. This is now a problem in ISDN. Every consumer who wants to buy ISDN services must identify the kind of digital switches operating in their central office and then be sure to purchase the

equipment which is compatible with that switch. Once the consumer has identified the correct equipment, he or she must then set it up properly. Then, on a call-by-call basis, if the ISDN "call" spans more than one central office, the consumer must make certain that the ISDN switches are compatible. Finally, although it is not strictly speaking a telecommunications problem, the consumer must also make sure that there is compatibility between the sender and receiver's ISDN application. While these are not insurmountable problems, the degree of difficulty may be enough to discourage a substantial number of users who would be interested in accessing many of the services that become available with ISDN subscriptions.[28]

Organizational service processes have become more critical in the installation of ISDN at the customer's site. All levels of customer interfaces require a level of knowledge and decision making not required for analog service. Both the novelty and the complexity of ISDN may conspire to make this a problem. Moreover, there are back-office steps such as provisioning and testing which cannot be as easily automated as for analog service. One of the key "moments of truth" is the verification of fitness for use as part of installation, especially when the ISDN circuit supports a third-party application. In the case of video teleconferencing, a common ISDN application, the carrier must ensure the quality of the network between two ISDN sites, but a third party would ensure the proper functioning of the video equipment.

It could be reasonably argued that the Bell operating companies and other large carriers serving potentially lucrative metropolitan markets for ISDN have an interest in ensuring that this process goes smoothly. Yet, it appears that some may have lost many of the technical personnel needed to fully service requests for information and assistance. Lack of training, lack of resources devoted to ISDN

---

[28] The North American ISDN Forum was formed by the National Institute of Standards and Technology to help coordinate these many different implementations of ISDN. It also serves as a forum whereby users can work together with providers on the design and conformance testing of equipment and services.

and incentive plans based on factors other than whether the service works as designed may also be problems. Although no scientific survey substantiates it, some news groups and discussion groups complain about the lack of attention and knowledge paid by Bell operating companies to requests for help and assistance on ISDN. Indeed, this is often the response given when questions about service quality are raised. At present, the only recourse for the prospective ISDN user is to wait for competition, hire a consultant, work with others in user groups, or hope that the companies answer their questions.

Another critical issue in any quality of service discussion is the availability of service. ISDN is only available to those consumers who are served by properly upgraded central office switches. The current specification for ISDN limits service to customers within approximately three miles or less from their central office. ISDN is not likely to be considered a universal service requirement (at least in the near future), so policy makers must address any incentives to make it available in rural or poor areas. Compounding this difficulty is the fact that rural lines have been "conditioned" so as to improve their voice line characteristics. Yet, as noted above, the taps and repeaters which do the conditioning consider data transmission "noise" and make it impossible for ISDN to be provisioned in an area where there are conditioned lines.

As the discussion of ISDN illustrates, the evolution of technology and markets challenges a rethinking of the public interest concerns in telecommunications service quality.

The question for regulators is whether bringing ISDN to rural areas is a quality of service issue, a universal service issue, or simply a matter for the market to decide. In an era where access to the Internet may become vital for businesses and customers, ISDN may quickly go from being a luxury to a vital necessity. This is a distinct possibility given the very steep growth of the Internet technology.

Conclusion

As the discussion of ISDN illustrates, the evolution of technology and markets calls for a rethinking of the public interest concerns in telecommunications service quality. Ideally, the industry would solve all such problems through the discipline of the market and their own standardization processes. We will see later why it may be difficult for the private sector to accomplish this. First, though, let us turn to an overview of what state regulatory commissions are now doing to adapt to changing needs for oversight of service quality.

CHAPTER 3

COMMISSION QUALITY OF SERVICE INITIATIVES

Concerned about the impact of changing technology, market structure, regulatory mechanisms and interconnection needs on telecommunications quality of service, many state regulatory commissions have taken action to improve their service quality programs. This chapter provides an overview of recent state initiatives in telecommunications quality of service, based on a survey of selected states. The results show that commissions are moving ahead to strengthen protective regulation, often in conjunction with new forms of economic regulation. More than 30 regulatory jurisdictions have instituted new standards or revised existing ones. Almost all have made them more stringent. Further discussion of commission programs in protective regulation, and recommendations on improvements, will be presented in chapter 6. The focus of this chapter is the survey results.

More than 30 regulatory jurisdictions have instituted new standards or revised existing ones. Almost all have made them more stringent.

In an NRRI survey conducted in the summer of 1994, regulatory commission staff in 32 states and the District of Columbia reported that their commissions had instituted or revised telecommunications quality of service standards since the AT&T divestiture. In 1995, the NRRI followed up to learn more about the new standards. We conducted indepth surveys of commission staff from 32 of the 33 commissions over the telephone, first faxing the questions so they could review them in advance.[1] Most states not included in the survey do have formal quality of

[1] The Oklahoma Corporation Commission did not participate in the survey, which was begun around the time of the bombing of the Oklahoma City federal building.

service standards but did not report substantial changes to them in the past 11 years. (See Appendix A for the survey and Appendix B for a list of the respondents.)

The NRRI survey built on a NARUC compilation of information on methods used by state regulatory agencies for service quality evaluation. In 1992 the Staff Subcommittee on Service Quality published a *Telephone Service Quality Handbook* intended to assist regulatory agencies in developing and administering service quality programs.[2] The *Handbook* identifies four tools a regulatory agency might use, depending on its resources: customer complaint analysis, performance standards and analysis, field investigations, and customer surveys. The *Handbook* contains examples of forms, letters, and surveys that a commission might adapt to its own service quality program. The *Handbook* also contains results from a survey of the states conducted in the late 1980s on telecommunications service quality programs. Thirteen respondents to the NRRI survey noted that they had used the NARUC work as an aid in designing their programs. Appendix C updates and amplifies portions of the *Handbook* based on the NRRI survey.

Topics covered in the NRRI survey include the origins, applicability, type, scope, and measurement of service quality standards. Monitoring, enforcement, and evaluation of the effectiveness of standards were also investigated. The surveys were completed by telecommunications engineers, analysts, and consumer affairs staff.

---

[2] National Association of Regulatory Utility Commissioners, *Telephone Service Quality Handbook* (Washington, D.C.: NARUC, 1992).

Origin and Applicability of Standards

Most of the new telecommunications quality of service standards are quite recent: of the 32 states included in the survey, 28 have revised their standards or instituted new ones since the beginning of 1990 (see Table 3-1). Twenty-three states revised existing standards; nine initiated them. In Vermont, standards were implemented in conjunction with alternative regulation in 1989. Since the alternative regulatory scheme expired, the state has not had formal service standards. The Public Service Board was working on developing new ones at the time of the survey. Wyoming had never formally codified standards applicable to all local exchange carriers. Instead, standards were brought into being case by case. The Wyoming Commission was under a legislative mandate to develop and codify formal standards at the time of the survey. Table 3-1 does not distinguish between major and minor revisions to standards, nor does it show how frequently changes have been made. In Pennsylvania, for example, changes have been made annually.

New or revised standards in all 32 jurisdictions applied to local exchange carriers (Table 3-2). Arizona, Nevada and New Hampshire have revised standards specifically for the Bell operating companies in their states. Arizona adopted standards for U S West in conjunction with a rate increase granted in January 1995. Nevada instituted standards specifically for companies opting for a revenue sharing form of alternative regulation, and Pacific Telesis was the only local exchange carrier to do so. Standards in New Hampshire were the result of an agreement between Commission staff and Nynex.

Fourteen commissions have standards for interexchange carriers and 17 for customer-owned pay telephones. Other services whose providers are subject to new or revised standards include shared tenant services (seven commissions); alternative operator services (15 commissions); and the hospitality industry (six commissions).

TABLE 3-1
COMMISSIONS THAT REPORTED AMENDED OR NEW QUALITY OF SERVICE STANDARDS SINCE 1984
(as of July 1995)

Commission	Year of Most Recent Standards	Type of Action	Further Revisions Planned by June 1996
Alabama	1992	Revised	No
Arizona	1995	Initiated	No
Arkansas	1994	Revised	No
California	1992	Revised	Yes
Colorado	1992	Revised	Yes
Connecticut	1993	Revised	Yes
Delaware	1991	Initiated	No
District of Columbia	1994	Initiated	No
Florida	1993	Revised	Yes
Idaho	1992	Initiated	Yes
Illinois	1991	Revised	No
Iowa	1991	Revised	Yes
Kansas	1984	Revised	Yes
Massachusetts	1995	Revised	No
Michigan	1992	Initiated	No
Montana	1989	Initiated	No
Nebraska	1990	Revised[a]	Yes
Nevada	1991	Initiated	No
New Hampshire	1991	Revised	No
New Jersey	1987	Revised	Yes
New Mexico	1994	Initiated	No
New York	1995	Revised	Yes
Ohio	1994	Revised	Yes
Oregon	1991	Revised	No
Pennsylvania	1994	Revised	Yes
Rhode Island	1991	Revised	Yes
Tennessee	1992	Revised	Yes
Texas	1995	Revised	No
Virginia	1993	Initiated	No
Vermont	1989 to 1993	Revised	Yes
Wisconsin	1992	Revised	Yes
Wyoming	Within last five years	Revised	Yes

[a] Nebraska's language was updated but standards were not changed.

Source: NRRI Survey of Selected States, summer 1995.

TABLE 3-2

TYPES OF PROVIDERS TO WHICH NEW OR REVISED TELECOMMUNICATIONS QUALITY OF SERVICE STANDARDS APPLY (as of July 1995)

Providers	Commissions
Local exchange carriers	AL, AZ, AR, CA, CO, CT, DE, DC, FL, ID, IL, IA, KS, MA, MI, MT, NE, NV, NH, NJ, NM, NY, OH, OR, PA, RI, TN, TX, VA, VT, WI, WY
Interexchange carriers	AL, AR, CA, CO, DE, FL, IL, IA, MI, MT, NE, PA, TX, WY
Customer-owned pay telephones	AL, AR, CO, DE, DC, FL, IL, MT, NE, NM, PA, RI, TN, TX, VA, VT, WY
Shared tenant services	AL, CO, CT, FL, OR, PA, WY
Alternative operator services	AL, AR, CA, CO, CT, FL, IL, IA, MI, NE, NM, OR, PA, TX, WY
Hospitality industry	AL, CA, FL, NM, OR, PA

Note: See Appendix D for a key to abbreviations of state names.

Source: NRRI Survey of Selected States, summer 1995.

TABLE 3-3

SERVICES COVERED BY MOST RECENT QUALITY OF SERVICE STANDARDS

Services to Which Standards Apply	Commissions
All services	AL, AZ, AR, CA, CO, CT, DE, DC, FL, IL, IA, MT, NE, NJ, OH, OR, PA, RI, TN, VT, WY
Only noncompetitive or basic services	MA, MI, NM, NY, TX, VA, WI
Other	ID, KS, NV

Source: NRRI Survey of Selected States, summer 1995.

In 21 states, standards cover all telephone services (Table 3-3); in six, only basic or noncompetitive services. Nevada's standards cover a mix of basic and discretionary services. In Kansas, standards in effect at the time of the survey applied only to billing, collection, and disconnection. In Idaho, standards only applied to out-of-service repair.

Reasons for New Standards

Table 3-4 categorizes the reasons offered by staff for recent changes in telecommunications quality of service standards or institution of new ones. Changing technology was the most frequently cited reason. Potential for service deterioration was cited by ten respondents. Changes in utility regulation and reporting requirements were also mentioned, mostly in addition to the threat of service deterioration or changing technology. For some states, the changes in utility regulation or reporting requirements were connected to alternative regulation, an area that will be treated in more depth below. Other reasons given included a need for clarification of language (Arkansas, California, Nebraska, and Wisconsin); customer complaints (Arizona, Idaho, and Massachusetts); a need for minimum requirements (Kansas); complaints from companies about reporting requirements (Pennsylvania); and a need for an overall scoring method (Florida).

Changing Technology

Fifteen survey respondents cited changes in telecommunications technology as a reason for new service quality standards. Staff respondents from Alabama and Wisconsin specifically mentioned the transition to digital switching and equipment upgrades. A decision by the Connecticut Department of Utility Control

TABLE 3-4 WHY STANDARDS WERE INSTITUTED OR REVISED (as of July 1995)	
Reasons for New or Revised Standards[a]	**Commissions**
Potential for service deterioration	AR, CO, MT, NV, NH, NM, OH, OR, VA, VT
Changing technology	AL, AR, CT, DE, FL, IL, IA, NY, OH, OR, PA, RI, TX, WI, WY
Change in utility regulation	AL, CT, DC, IL, NH, NY, OH, TX
Change of reporting requirements instituted by commission	DE, DC, MI, NV, NJ, RI, TN
Other	AR, AZ, CA, ID, FL, KS, MA, NE, PA, WI

[a] Respondents could cite more than one reason.

Source: NRRI Survey of Selected States, summer 1995.

provides an example of some of the issues other respondents are likely to have had in mind:

> The Company indicated that with the advent of digital switches that have inherent capabilities of almost instantaneous response, dial tone speed has become meaningless as a measure of customer service...The Company also testified that its network is continuously monitored for transmission quality and noise levels utilizing standards and criteria developed by Bellcore and the former Bell system organization. The Department believes that these measures need not be reported because of their decreasing significance, and because [trouble reports per hundred lines] will capture customer complaints about dial tone delays and static or noise.[3]

[3] Connecticut Department of Public Utility Control, *Application of the Southern New England Telephone Company to Amend Its Rates and Rate Structure,* Docket No. 92-09-19 (New Britain, CT: Connecticut DPUC, July 7, 1993), 57.

Deterioration of Service

Staff from ten commissions cited potential deterioration in service quality as a reason for changing standards. New Mexico, for example, opened a docket in May 1994 "to consider formal action with regard to the matter of U S West's held orders, including the development of service standards and commitments, installation requirements, alternative services requirements, and record keeping and reporting requirements."[4] The result was a stipulated agreement among U S West, Commission staff and the Attorney General which set the first service standards for the company in New Mexico. The Arkansas staff respondent said the Commission revised standards because of problems between the company and customers on billing, collections, and service cut-off. The new standards give the Commission greater scope in this area and make time frames for action more specific.

Other Reasons

Respondents cited a number of other reasons besides new technology and declining service to explain the impetus toward new standards. These included the advent of competition, coverage of new services, customer demand, a need to clarify language, and changed reporting requirements.

The Delaware Commission instituted standards in 1991 in anticipation of intrastate competition:

> Should competition be approved, several carriers would be in a position to provide telecommunications services in Delaware. Whether or not competitive services evolve, the Commission has a

[4] New Mexico State Corporation Commission, *In the Matter of the Held Orders of U S West Communications,* Docket No. 94-192-TC (Sante Fe, NM: New Mexico SCC, Nov. 14, 1994), 1.

> statutory obligation to assure that telecommunications carriers providing service to the public and doing business in this state have networks that are technologically capable of providing telephone service which is efficient, sufficient and adequate.[5]

Arizona, Idaho, and Massachusetts reported customer complaints as a reason for standard setting. In Massachusetts, the Department of Public Utilities opened a proceeding in 1990 on cost-based pricing and cross subsidies. Customer complaints surfaced during the accompanying investigation and the Department became "concerned that NET [New England Telephone] did not have any effective means to measure accurately and report on its quality of service."[6]

The Department again revised standards in 1995 because the company performed better than expected. The company more than met the thresholds established in 1990 for installation, repair, transmission, operator assisted calls, customer satisfaction, customer appointments and access to the business office. As the Department considered price regulation, Commissioners and staff did not want to set thresholds lower than current company performance, according to the survey respondent, so standards were again revised.

In Alabama, 1992 revisions to quality of service standards were made in part to cover services new to the state since 1983, when the standards were first written. For example, standards for alternative operator services were added to those for operator assisted calls; and standards for billing and collection were revised to cover the local exchange company providing those services for other companies.

---

[5] Delaware Public Service Commission, *In the Matter of the Proposed Adoption of Regulation Governing the Minimum Service Requirement for the Provision of Telephone Service for Public Use Within the State of Delaware,* Order No. 3232 (Delaware PSC, Jan. 15, 1991), 8.

[6] Massachusetts Department of Public Utilities, D.P.U. 89-300 (Boston, MA: Massachusetts DPU, June 29, 1990), 290.

The Wisconsin Commission made changes in the rules governing a customer's disconnection for nonpayment of some part of the bill because of customer demand, said the staff respondent to the NRRI survey. The respondent in Texas said that standards were revised in the year preceding the survey in order to incorporate surveillance standards for installation, repair, operator assisted calls, and transmission. The representative of the New Hampshire Commission explained that standards for services such as installation and operator assisted calls were made more stringent by more definite time frames and/or percentage of calls handled. A need to clarify language was also cited by Arkansas, California, Nebraska, and Wisconsin as a reason to revise quality of service requirements. In Kansas, which wrote quality of service standards from scratch in 1984, the staff respondent said a need for minimum requirements for all utilities was the motivation.

In Tennessee, the existing minimum service standards were made more stringent for installation, repair, customer appointments, and customer satisfaction for those companies adopting incentive regulation. The staff member explained that this was done because of concern on the part of Commission staff that companies would reduce their service in more rural parts of the state to compete more effectively in the urban areas.

The Pennsylvania staff member responding to the survey said complaints from companies about reporting requirements were one reason standards were revised. He also cited issues in billing and collection brought on by a Federal Communications Commission ruling. The Public Utility Commission amended state quality of service regulations to specifically cover billing and collection practices for information service charges.[7]

---

[7] Pennsylvania Public Utility Commission, *Declaratory Order re LEC Billing of Pay-Per-Call and Similar Information Services,* Docket No. M-00940569 (Harrisburg, PA: Pennsylvania PUC, July 21, 1994).

Finally, the Florida Public Service Commission took a highly proactive approach to revising quality of service standards, citing a need for an overall scoring method, not simply a "pass/fail" approach. The Florida quality of service system will be discussed at greater length below and again in chapter 5.

Current Service Quality Problems

Table 3-5 gives further information on current service problems of local exchange carriers, in response to questions on the survey. Twenty-four commissions cited problems with the Bell operating companies, and only seven commissions with independent companies. (These problems are not necessarily connected to decisions to revise service quality standards since they relate to current problems, which might not be those that precipitated a decision to implement new standards.)

Several staff members said that personnel cuts were responsible for some of the service quality difficulties at Bell operating companies. Arizona, Montana, and Oregon staff all suggested that lack of personnel hindered U S West from meeting requirements. The California, New Hampshire, and New York respondents also mentioned loss of personnel as a problem.

Other reasons given for problems with Bell operating companies were the weather (California and Rhode Island), difficulties working with contractors (Iowa), and reorganization (Arizona). None of the commissions in the sample served by Bell Atlantic reported any serious problems for that company.

The Alabama staff member said deployment of memory services was generating problems for both large and small companies in the state. Other causes of problems cited for smaller companies included vulnerability to cable cuts (Alabama, Illinois, and Nebraska), and old plant (Kansas and Arkansas).

TABLE 3-5
QUALITY OF SERVICE STANDARDS
LOCAL EXCHANGE CARRIERS HAVE HAD TROUBLE MEETING
(as of July 1995, as reported by commission staff)

State	Difficulties for Bell Operating Companies	Difficulties for Independents and Small Companies
Alabama	Trouble reports per hundred lines (BellSouth)	Trouble reports per hundred lines
Arizona	Out-of-service repair within 24 hours; installation of new service and access to personnel in the business and repair office (U S West)	None
Arkansas	Providing service within five days (Southwestern Bell)	Call completions
California	Answering calls to business office within 20 seconds and in making appointments for service repair within eight hours (which is company standard posted with tariffs) (PacTel)	For GTE, similar to PacTel but also had problems in the past because of personnel cuts
Colorado	Repairing out-of-service within 24 hours, held orders and not meeting standard for customer access to personnel at the business office (U S West)	None
Connecticut	N.A.	None
Delaware	None (Bell Atlantic)	N.A.
District of Columbia	Since new service standards were implemented in 1994, company has not filed a report (Bell Atlantic)	N.A.
Florida	Service restored by 3:00 pm of day reported; all phases of repair service as well as installation delays (BellSouth)	Generally no problems
Georgia	Occasionally trouble per hundred lines (BellSouth)	Occasionally trouble per hundred lines
Idaho	Meeting out-of-service repair commitments in both northern and southern Idaho (problem much worse in north) and eliminating held orders (U S West)	Few problems

TABLE 3-5 (Cont.)
QUALITY OF SERVICE STANDARDS
LOCAL EXCHANGE CARRIERS HAVE HAD TROUBLE MEETING
(as of July 1995, as reported by commission staff)

State	Difficulties for Bell Operating Companies	Difficulties for Independents and Small Companies
Illinois	Meeting 95 percent out-of-service repair in 24 hours, interoffice trunk traffic, installation, and installation of network interface (Ameritech)	Problems that arise because of service outage caused by cut cables and other problems
Iowa	Held orders and installation (U S West)	No complaints against small companies but several complaints against GTE for noise or other problems on the line
Kansas	None	United has transmission and switching quality problems
Massachusetts	Clearing residential trouble reports, meeting residential and business expectations for maintenance, and meeting 18 second answer time for repair service department (Nynex)	Don't track these because they are so small
Michigan	None (Ameritech)	None
Missouri	None (Southwestern Bell)	None
Montana	Installation, repair, and meeting customer appointments for installation and repair (U S West)	None
Nebraska	Installation, repair, answer time at business office (U S West)	Trouble reports per 100 lines
Nevada	Meeting answering time at business office (U S West)	None
New Hampshire	Repair of out-of service within 24 hours, answering business phones within 20 seconds (Nynex)	None
New Jersey	Company operating well within established standards (Bell Atlantic)	None

TABLE 3-5 (Cont.)
QUALITY OF SERVICE STANDARDS
LOCAL EXCHANGE CARRIERS HAVE HAD TROUBLE MEETING
(as of July 1995, as reported by commission staff)

State	Difficulties for Bell Operating Companies	Difficulties for Independents and Small Companies
New Mexico	Standards for held orders, installation or repair (U S West)	None
New York	Repair for out-of-service residential service in New York City, repair appointments, trouble reports per 100 lines in the central office (Nynex)	For Rochester Telephone, problems with operator services and operator access
Ohio	Answer time in business office (Ameritech)	None
Oregon	Held orders and out-of-service repair (U S West)	None
Pennsylvania	No record of any (Bell Atlantic)	None
Rhode Island	Clearing out-of-service reports within 24 hours (Nynex)	None
Tennessee	Customer appointments, repair and customer satisfaction (BellSouth)	None
Texas	Operator answer time (Southwestern Bell)	None
Virginia	None with any frequency (Bell Atlantic)	None
Vermont	Installation, repair, and answering business office phone with a live operator (Nynex)	None
Wisconsin	Clearing out-of-service reports within 24 hours; repeat troubles where company can't locate source of problem; reaching a live operator at the business office within a reasonable time (Ameritech)	Repeat troubles, meaning company is unable to locate problem; setting up flexible payment plans for the financially disadvantaged
Wyoming	Providing live operator service at the business and repair offices within a reasonable length of time (U S West)	None

N.A. = Not applicable.

Source: NRRI Survey of Selected States, summer 1995.

The Relationship of Old Standards and Modes of Regulation to New Ones

Of considerable interest in an investigation of changing service quality standards is the relationship of standards to new forms of regulation, such as price caps. States could revise or institute service quality standards independently of initiating alternative regulation or in conjunction with it. If they revised standards in conjunction with alternative regulation, they could later change the form of regulation. Some states could well have begun alternative regulation and tied it to existing standards, but the NRRI's initial screening, which asked only for states that had made revisions in standards, would have eliminated them from the sample.

Table 3-6 shows the relationship between new or revised service quality standards and alternatives to ratebase, rate-of-return regulation in effect at the time of the NRRI survey for the states in the sample. The type of regulation in effect at the time of the standards setting may have been different. Three types of alternative regulation are distinguished. Incentive plans include both sharing and Nebraska's statewide incentive system. Sharing plans provide incentives to companies for improved efficiency by allowing allocation of revenues or profits between companies and ratepayers according to prescribed formulas. Nebraska allows considerable freedom to companies to set rates, although the Commission may step in if rates go up by more than 10 percent or a certain percentage of customers petition the Commission. Distinctions between basic and nonbasic services allow the companies relaxed regulation or deregulation of services deemed competitive, while maintaining regulation of core, noncompetitive services. Price caps focus on prices rather than utility revenue requirements, limiting price changes through ceilings and sometimes floors.

More than half of the commissions (18) participating in the survey have not revised service quality standards in direct conjunction with beginning alternative regulation. For 14 of the jurisdictions, including Vermont under its "social contract" form of regulation, quality of service standards revisions were or are tied into an alternative regulation plan.

TABLE 3-6

LINKAGE BETWEEN NEW OR REVISED QUALITY OF SERVICE STANDARDS AND FORM OF REGULATION FOR SELECTED STATES[a]

	Form of Regulation in effect as of July 1995[b]			
Relationship of Instituting or Revising Standards to Alternative Regulation	**Ratebase, Rate-of-Return**	**Incentives: Revenue/ Profit Sharing or Other Broad Incentives**	**Basic/Nonbasic Distinction**	**Price Caps**
Not directly related	AR, NH, NM, OK	AL, NE, VA	AZ, CT, ID, MT, KS, WI, WY	DE, FL, IA, MA, PA
Directly related	VT	DC, NV, TN, TX	–	CA, CO, IL, MI, NJ, NY, OH, OR, RI

[a] Includes only those jurisdictions in the NRRI survey of selected states, summer 1995. Nevada, Tennessee and Texas have passed legislation allowing price regulation but no company had yet been authorized to operate under it.

[b] Instituting or revising standards may have been undertaken with an earlier form of alternative regulation.

Source: NRRI Survey of Selected States, summer 1995.

A little more than half of the commissions (18) participating in the survey have not revised service quality standards in direct conjunction with beginning alternative regulation. For 14 of the jurisdictions, including Vermont under its "social contract" form of regulation, quality of service standards revisions were or are tied into an alternative regulation plan. For nine commissions, staff respondents reported that quality of service standards were not developed for statewide applicability but as part of alternative regulation specifically for companies choosing the new regulatory form (Colorado, the District of Columbia, Nevada, New Jersey, New York, Oregon, Rhode Island, Tennessee, and Texas). In Michigan, quality of service standards were established as part of Telecommunications Act 179, under which services, rather than companies, were deregulated.

The California Public Utilities Commission offers a concise statement of the concern that price regulation may be an incentive to allow service to deteriorate:

> DRA [Division of Ratepayer Advocates] fears that incentive-based regulatory frameworks could have unintended consequences on service quality. For example, the local exchange carrier could decide to cut or delay maintenance or improvement investments in order to improve short-run financial results.[8]

For each state in the sample which reported a connection between new and revised standards and alternative regulation, Table 3-7 shows the procedural and substantive linkage between the two. The enforcement provisions for service quality will be discussed further below.

Dimensions of Quality Addressed

Even a cursory comparison of the standards adopted by the commissions included in the NRRI survey reveals that the emphasis is very much on traditional measures of reliability and availability. Florida's extensive list of service quality indicators (Table 3-8) is derived only from those criteria. (See Appendix C, Table C-1 for types of standards reported by the commissions in the NRRI survey.) The centrality of these measures to regulation of telecommunications service quality does not mean that commissions are inattentive to the other dimensions of quality discussed in chapter 2, nor that those issues should be addressed in a program labeled "quality of service." Frequently they are being resolved through mechanisms other than standards, such as one-time policy decisions. Simplicity,

---

[8] California Public Utilities Commission, *In the Matter of Application of Alternative Regulatory Frameworks for Local Exchange Carriers,* Decision 89-10-013 (Sacramento, CA: California PUC, Oct. 12, 1989), 303.

TABLE 3-7
CONNECTION BETWEEN ALTERNATIVE REGULATION AND NEW OR REVISED SERVICE QUALITY STANDARDS FOR SELECTED STATES
(as of July 1995)

Commission	Connection Between Alternative Regulation and Service Quality
California	Effective Jan. 1, 1990, California adopted a price cap plan for both Pacific Telesis and GTE. Although the Commission did not revise its service quality standards at the time, it did institute an expansion of the service quality monitoring program (California Public Utilities Commission, *In the Matter of Application of Alternative Regulatory Frameworks for Local Exchange Carriers,* Decision 89-10-013, Docket No. I. 87-11-033 et al., Oct. 12, 1989, 305).
Colorado	The Colorado Public Utility Commission in 1992 adopted a five-year earnings sharing plan to commence Jan. 1, 1993. The sharing threshold could be modified, up or down, depending on U S West's overall performance on quality of service measurements (Colorado Public Service Commission, *Regarding the Application of the Mountain States Telephone and Telegraph Company D/B/A U S West Communications, for Approval of the Rate and Service Regulation Plan,* Docket No. 90-A-665T, Decision C92-854, Exhibit A, May 26, 1992, 46). As of June 1, 1995, Colorado PUC adopted price regulation, capping basic exchange rates at current levels. Caps can change annually by the GDP-PI minus a Commission-determined productivity offset not greater than 5 percent. However, rate increases can be disallowed if a telephone company fails to meet service quality standards (*State Telephone Regulation Report* 13, no. 11 [June 1, 1995]: 8).
District of Columbia	When an earnings sharing plan was adopted in 1993, the Commission established a working group to draft standards for the Chesapeake and Potomac Telephone Company. These standards have been in effect since August of 1994 (District of Columbia Public Service Commission, *In the Matter of the Investigation into the Impact of the AT&T Divestiture and Decisions of the Federal Communications Commission on the Chesapeake and Potomac Telephone Company's Jurisdictional Rates,* Formal Case 814, Phase III, Order No. 10483, Aug. 26, 1994, 37).
Illinois	The Commerce Commission adopted price regulation Oct. 11, 1994, effective Jan. 1, 1995, incorporating a service quality component in the price cap formula (Illinois Commerce Commission, *Illinois Bell Telephone Company Petition to Regulate Rates and Charges of Noncompetitive Services under an Alternative Form of Regulation and Complaint for an Investigation and Reduction of Illinois Bell Telephone Company's Rates under Article IX of the Public Utilities Act,* Docket No. 92-0448/93-0239, Oct. 11, 1994).

TABLE 3-7 (Cont.)
CONNECTION BETWEEN ALTERNATIVE REGULATION AND NEW OR REVISED SERVICE QUALITY STANDARDS FOR SELECTED STATES
(as of July 1995)

Commission	Connection Between Alternative Regulation and Service Quality
Michigan	Telecommunications reform legislation enacted on Jan. 1, 1992, instituted price caps and required the Commission to establish quality of service standards. These standards were formally adopted Sept. 11, 1992. At that time, the Attorney General argued for some type of financial penalty when companies' performance did not meet the established standards, but the Commission rejected this argument because alternative regulation had been in place for such a short time (Michigan Public Service Commission, *In the Matter, on the Commission's Own Motion, to Establish Quality of Service Standards for Regulated Telecommunications Services under the Michigan Telecommunications Act,* Case No. U-10063, Sept. 11, 1992).
Nevada	On July 2, 1990, Nevada adopted a generic incentive regulation plan. Once Nevada Bell applied for regulation under the new plan, quality of service standards were developed and applied exclusively to Nevada Bell as the only company being regulated under the incentive plan (Nevada Public Service Commission, Docket No. 89751/91-2068, May 20, 1991).
New Jersey	The Board of Public Utilities May 6, 1993, formally adopted a price regulation plan for New Jersey Bell. Standards already in place were kept and a provision allowing the Board to terminate the plan if "substantial degradation of service is found to exist" was retained (New Jersey BPU, *In the Matter of the Applications of New Jersey Bell Telephone Company for Approval of Its Plan for an Alternative Form of Regulation,* Docket No. T092030358, May 6, 1993, 139).
New York	In New York, approval of the restructuring plan for Rochester Telephone included specification of a floor for service quality determined by traditional measures, customer complaints, and customer satisfaction surveys (New York Public Service Commission, *Opinion and Order Approving Joint Stipulation and Agreement,* Petition of Rochester Telephone Corporation for Approval of Proposed Restructuring Plan, Case 93-C-0103 and Petition of Rochester Telephone Corporation for Approval of a New Multi-Year Rate Stability Agreement, Nov. 10, 1994). Nynex's price regulation plan, approved by the New York Commission in 1995, includes extensive service quality requirements (New York PSC, Opinion No. 95-13, issued Aug. 16, 1995, *Adoption of Performance Based Regulation Plan for New York Telephone,* Case No. 992-C-0665).

TABLE 3-7 (Cont.)
CONNECTION BETWEEN ALTERNATIVE REGULATION AND NEW OR REVISED SERVICE QUALITY STANDARDS FOR SELECTED STATES
(as of July 1995)

Commission	Connection Between Alternative Regulation and Service Quality
Ohio	The Public Utilities Commission of Ohio formally adopted a price regulation plan for Ameritech-Ohio on Nov. 23, 1994. Quality of service standards were not revised at that time but financial penalties for noncompliance with current standards were adopted. These penalties were incorporated as part of the price cap formula applicable to the company (Ohio PUC, *In the Matter of the Application of The Ohio Bell Telephone Company for Approval of an Alternative Form of Regulation,* Case No. 93-487-TP-ALT, and *In the Matter of the Complaint of the Office of the Consumers' Counsel* v. *The Ohio Bell Telephone Company,* Case No. 93-576-TP-CSS, Nov. 23, 1994).
Oregon	A price regulation plan with revenue sharing was approved Nov. 25, 1991, and accepted by U S West Dec. 16, 1991. Service standards were already in effect in Oregon but a more rigorous reporting schedule was outlined and baseline performance standards for each central office were established. Should the Company fail to comply with the established standards, the Commission can terminate the alternative regulation plan (Oregon Public Utility Commission, *In the Matter of the Petition of U S West Communications, Inc., to Price -List Telecommunications Services Other than Essential Local Exchange Services,* Order No. 91-1598, Nov. 25, 1991).
Rhode Island	The Public Utilities Commission adopted price regulation on Oct. 6, 1992. At that time, quality of service standards were revised and a service quality index was developed. This index requires monthly measurements and the rating of 41 auditable quality of service indicators. If the service quality index falls below prescribed levels in any month, the effective date of any proposed price changes are similarly delayed. (Rhode Island PUC, *In RE: Comprehensive Review of Telecommunications in Rhode Island,* Docket No. 1997, Order No. 14038, Oct. 6, 1992).

TABLE 3-7 (Cont.)
CONNECTION BETWEEN ALTERNATIVE REGULATION AND NEW OR REVISED SERVICE QUALITY STANDARDS FOR SELECTED STATES
(as of July 1995)

Commission	Connection Between Alternative Regulation and Service Quality
Tennessee	An incentive regulation plan in effect from Jan. 1, 1990 to Dec. 31, 1992, and extended to Dec. 31, 1995, applied to all local exchange carriers with more than 70,000 access lines and provides for revenue sharing (Tennessee Public Service Commission Rule 1220-4-2-.43, *Regulatory Reform Plan for Telephone Companies*, July 31, 1990; Rule 1220-4-2.55, *Regulatory Reform*, Nov. 13, 1992). Quality of service standards were not revised in 1990 but the amount the company could retain under the revenue sharing provision varies depending on the level of service provided. On June 6, 1995, Tennessee established a price regulation framework for local exchange companies (Tennessee Statute HB 695/SB891, June 6, 1995). BellSouth filed an application to operate under price regulation on June 20, 1995 (*BellSouth Regulatory Reform: A Nationwide Summary,* June 1995, Issue No. 17). Revisions to the quality of service standards were anticipated.
Texas	Legislation passed May 26, 1995, established price regulation, effective Sept. 1, 1995. Under the new legislation, basic rates are frozen for four years at June 1, 1995 levels, then come under price caps indexed to the consumer price index minus a Commission-determined productivity offset. As a condition of price cap regulation, companies must meet recently revised quality of service standards and must make specified infrastructure investments by 2000 (Texas Statute HB 2128, May 26, 1995).
Vermont	On Dec. 30, 1988, the Vermont Public Service Board approved the Vermont Telecommunications Agreement (VTA) submitted by New England Telephone and Telegraph (NET) and the Vermont Department of Public Service. The contract term was originally three years but the Company was given two one-year extensions, terminating the plan in December 1993. The agreement eliminated rate-of-return regulation and oversight of earnings. NET was given substantial freedom to offer new services while capping rates for basic local services. As part of this agreement, the Company promised to meet service standards. If the Company's performance was below standards, the Department could petition the Board to reduce rates or order customer refunds (Vermont PSB, *Vermont Telecommunications Agreement I*, 1988), 22-23.

Source: NRRI Survey of Selected States, summer 1995, and applicable documents.

TABLE 3-8
FLORIDA PUBLIC SERVICE COMMISSION
RULES FOR RESIDENTIAL SERVICE

Rule Cluster 1. Dial Tone Delay

1. Dial Tone Delay: 95 percent of calls receive dial tone in three seconds.

Rule Cluster 2. Call Completions and Billing

2. Intraoffice: 95 percent of calls completed.
3. Interoffice: 95 percent of calls completed.
4. Extended Area Service: 95 percent of calls completed.
5. IntraLATA Direct Distance Dialing: 95 percent of calls completed.
6. InterLATA Direct Distance Dialing: 90 percent of calls completed by your provider.
7. 911 Service: 100 percent of calls delivered to the 911 authority.
8. Billing Accuracy: 97 percent of intraLATA calls are timed accurately.

Rule Cluster 3. Answer Time

9. Operator Answer Time: 90 percent of calls answered in 20 seconds.
10. Directory Assistance: 90 percent of calls answered in 20 seconds.
11. Repair Service: 90 percent of calls answered in 20 seconds.
12. Business Office: 80 percent of calls answered in 20 seconds.

Rule Cluster 4. Directory and Directory Assistance

13. Directory Service: 100 percent of the 18 rules about directory are met.
14. New Numbers: 100 percent of all new numbers are available in 48 hours.
15. Numbers in Directory: 99 percent of all numbers can be verified by the directory assistance operator.
16. Bill Accuracy: 97 percent of calls for directory assistance are billed correctly.

Rule Cluster 5. Intercept Services

17. Changed Numbers: 90 percent of calls answered in 20 seconds.
18. Disconnected Service: 80 percent of calls answered in 20 seconds.
19. Vacation Disconnects: 80 percent of calls answered in 20 seconds.
20. Vacant Numbers: 80 percent of calls answered in 20 seconds.
21. Disconnects NonPay: 100 percent of calls answered in 20 seconds.
22. Incorrectly Dated Calls: 95 percent of seven error types intercepted. An exchange where all seven types of errors are intercepted is in 100 percent compliance.
23. Power and Generators: 100 percent. An exchange with backup power or a generator is in 100 percent compliance.

Rule Cluster 6. Central Office

24. Scheduled Routine Program: 95 percent. An exchange on a scheduled routine maintenance program is in 100 percent compliance. One without such a program scores 0 percent.
25. Frame: 95 percent. A frame in satisfactory condition is in 100 percent compliance; otherwise, 0 percent.
26. Facilities: 95 percent. An exchange facility in satisfactory condition is in 100 percent compliance, otherwise, 0 percent.

Rule Cluster 7. Installation and Repair Services

27. Same Day Restoral: 80 percent restored on same day.
28. 24-Hour Restoral: 95 percent restored within 24 hours.
29. Repair Appointments: 95 percent of appointments kept.
30. Rebates–Over 24 hour: Provides rebates 100 percent of time.
31. 3-Day Primary Service: 90 percent of service installations must occur within three days of the request for service.
32. Primary Service Appointments: 90 percent of appointments kept.

Rule Cluster 8. Transmission

33. Dial Tone Level: 100 percent. An exchange with Dial Tone Level between -5 to -22 dBm is in 100 percent compliance.
34. Central Office Loss: 100 percent. An exchange with C.O. Loss of 0 to -2.5 dB is in 100 percent compliance.
35. M.W. Frequency: 100 percent. An exchange operating at a MW Frequency between 994 to 1014 Hz is in 100 percent compliance.
36. Central Office Noise, Metallic: 100 percent. An exchange operating with C.O. Noise, Metallic, of 20 dBrncO or less is in 100 percent compliance.
37. Central Office Noise, Impulse: 100 percent. An exchange operating with C.O. Noise, Impulse, of no more than five counts above 59 dBm in five minutes is in 100 percent compliance.
38. Test Numbers: 100 percent. An exchange with three-line rotary test numbers is in 100 percent compliance.
39. Subscriber Loops: 98 percent of subscriber loops have acceptable transmission performance.

Rule Cluster 9. Customer Complaints

40. Customer Complaints: The average number of complaints per 1,000 customers for the entire state of Florida is 0.074 (though no specific standard exists).

Source: John G. Lynch, Jr., Thomas E. Buzas, and Sanford V. Berg, "Regulatory Measurement and Evaluation of Telephone Service Quality," *Management Science* 40, no. 2 (February 1994): 186.

for example, is one of the issues that underlies recent commission efforts to make policy decisions on 1 + dialing and assignment of new area codes. Security has been a major focus of commission concern but development of standards is not the policy option they have chosen. Caller ID, for example, has been determined by one-time decisions and is not subject to ongoing debate. Thus, rules about it differ from those which require a percentage of compliance within a specified time frame; even one complaint about the conduct of the telephone company could trigger an investigation.

The NRRI survey, however, did touch on some of the additional dimensions of quality delineated in chapter 2: measurement of competition, choice, and universal service standards.

One means of advancing choice/flexibility is to assess the degree of competitiveness of a market for a telecommunications service. Our survey asked how a commission knows that the market for a service is competitive and whether that definition is a commission standard. Staff members in 12 states (Arizona, Colorado, Connecticut, the District of Columbia, Illinois, Iowa, Massachusetts, Michigan, Montana, New Jersey, Wisconsin, and Wyoming) affirmed that there was a method for determining whether competition exists and that it was considered a standard. Staff at three commissions (Delaware, New Mexico, and Vermont) said that such a decision was at the discretion of the commission but there was no standard. Several state commissions noted that they do not monitor the quality of service interexchange carriers provide, saying service standards are not needed because of the number of providers and the ease of changing carriers.

The development and introduction of new services may be considered an indication of choice. Company reports listing and describing new services might aid in such an assessment. Our survey asked commission staff if their commission had developed a method for measuring innovation in the telecommunications market. Of the 32 states surveyed, four indicated they had such a method and three said their commission was considering developing one. The California Commission, for

example, has required that local exchange carriers provide information on new services, including availability, rate of deployment, and usage.[9]

As noted in chapter 2, availability in telecommunications may be broadly construed to include universal service issues. Our survey asked if commissions had set or were planning to set goals for service availability. Montana and New Hampshire reported that they had set standards. Montana has a line-extension policy for rural areas. New Hampshire's staff representative pointed to their policy that one-party service is to be available on demand. Colorado, Connecticut, the District of Columbia, New Mexico, Tennessee, and Virginia all reported that they were considering setting standards for universal service. Although the number of states which said they have set a standard for universal service was small at the time of the survey, it is important to note that many states have telephone penetration rates above the national average and thus were not likely to feel the need to address this issue. The list has probably grown longer since the survey was conducted. Many states have dockets open to consider universal service programs and funding in the light of pending federal legislation.

The final dimension of service quality discussed in chapter 2 was "assurance," or company competence and credibility. One major tool that some commissions have developed to assess customer beliefs in this area is customer satisfaction surveys, which will be discussed below under monitoring performance and further in chapter 6.

Monitoring Performance

Monitoring of companies' compliance with specific standards usually occurs using one or more of three methods: company reports, customer complaints, and field investigations (see Table 3-9). Customer surveys are a fourth means of

---

[9] California Public Utilities Commission, Advisory and Compliance Division, *Monitoring Workshop II Report*, I-87-11-033, Phase 2 (Sacramento, CA: California PUC, Sept. 25, 1990), 29.

TABLE 3-9

METHODS COMMISSIONS USE TO MONITOR COMPANIES' PERFORMANCE ON QUALITY OF SERVICE STANDARDS (as of July 1995)

Methods of Monitoring	Commissions
Company reports	AL, AZ, AR, CA, CO, CT, DE, DC, FL, ID, IL, IA, MA, MT, NE, NV, NH, NJ, NM, NY, OH, OR, PA, RI, TN, TX, VA, WY
Customer complaints	AL, AZ, AR, CA, CO, CT, DE, DC, FL, ID, IL, IA, KS, MA, MI, MT, NE, NV, NH, NJ, NM, NY, OH, OR, PA, RI, TN, TX, VT, VA, WI, WY
Field investigations	AL, AR, CO, CT, DE, FL, ID, IL, MT, NE, NM, NY, OH, OR, PA, RI, TN, VA, WY

Source: NRRI Survey of Selected States, summer 1995.

monitoring but few states were using them at the time of the survey and they were not included in the NRRI's list of questions to commission staff. The choice of methods is often dependent on the budget and staff resources available at the commission as well as the professional qualifications of staff. The one method all commissions in the survey reported using was the monitoring of complaints by customers. Table 3-9 shows that all 32 commissions monitor customer complaints. Twenty-eight receive and monitor company reports and 19 conduct field investigations. Customer surveys, commission-ordered audits, and the FCC's automated monitoring system are other sources of monitoring information available to the commissions.

Commission staff cited a number of time frames and circumstances in which a company's quality of service performance was evaluated (Table 3-10). The most often cited circumstance was customer complaints or a commission order (29 commissions). Other triggers for commission evaluation occur during reviews of regulatory structure and the ordinary course of a rate case.

TABLE 3-10 TRIGGERS FOR COMMISSION EVALUATION OF COMPANY'S QUALITY OF SERVICE PERFORMANCE (as of July 1995)	
Time Interval	**Commissions**
During rate case	AZ, AR, CT, DE, FL, KS, MT, NE, NH, NY, OR, PA, TN, TX, WY
Review of alternative regulatory plan	CT, DC, FL, IL, NV, NY, OH, OR
Follow-up to complaints and/or by commission order	AL, AZ, AR, CA, CO, CT, DE, FL, IL, IA, KS, MI, MT, NE, NV, NH, NJ, NM, NY, OH, OR, PA, RI, TN, TX, VA, VT, WI, WY
Other	AL, ID, NJ, NY, OH, RI, TN, TX, VA

Source: NRRI Survey of Selected States, summer 1995.

COMPANY REPORTS

A single company report may deal with finances, construction, network configuration, and interconnection, as well as service quality. The service quality portion of such a report may cover service outages, missed appointments, operator answer time, or one of several other described standards. States differ widely in when reports are due, what they must cover, and units of observation. For some states, reports are required within certain time frames, whether or not a company is in compliance according to its own records. In others, a company is required to submit reports only when, according to its own records, it is out of compliance for a specified time period (see Appendix C, Table C-2). The units of observation most widely used are local exchange or central office. Because some exchanges are more prone to trouble than others (because of weather, terrain, or equipment),

companies seem to prefer to report problems in terms of total company within the state rather than by exchange. Few commissions monitor the interexchange carriers and only five commissions require interexchange carriers to file reports.

CUSTOMER COMPLAINTS

The NARUC *Handbook* provides a succinct rationale for a commission program to handle customer complaints:

> Perhaps the most important aspect of the service quality evaluation process is the handling, investigation and tabulation of customer complaints. Why? Because other indicators such as trouble reports and network performance results are given scant consideration by politicians and regulatory utility commissioners when customers complain about the service being rendered in an area.[10]

Most states categorize complaints both by utility and service. The NARUC *Handbook* suggests that customer complaints to the regulatory agency should not exceed a level of one per 1,000 access lines per year.

The NARUC *Handbook* briefly discusses the reasons customers may complain to the commission and concludes that overall, "It's usually because the company has not responded to a problem or inquiry in a satisfactory manner."[11] They offered three classifications of complaints: misunderstanding about a problem or delay in correcting one; rude personnel (that is, operators, service or repair personnel); service and/or billing problems. Our survey did not request such data but several staff respondents said that in their states the largest categories of complaints were billing and collections, disconnection and service problems. The

---

[10] NARUC, *Handbook,* 2.

[11] Ibid.

Handbook asserts that complaint monitoring is necessary even if other more costly programs are cut.

Staff at a couple of commissions expressed concern over the limited number of telephone lines available to a commission to receive calls from consumers. In some states, only two or three out of four of those wishing to reach the commission may be able to get through, they speculated. One staff member suggested that callers who do reach the commission are likely to have concerns about billing and possible disconnection for nonpayment. Such consumers are likely to have been more persistent than those with complaints about how long they had to wait to reach company personnel at the repair office or how long they were without service. The types of complaints that commissions receive may reflect this disparity.

FIELD TESTING

The NARUC *Handbook* says "a persuasive argument can be made that independent field audits and investigations, rather than utility reports and measurements, produce the only authentic measure of utility performance."[12] Twenty state regulatory agencies reported developing a programs of field testing for service quality in the NARUC survey. Nineteen of the 32 commissions participating in the NRRI survey reported that they use field testing to help measure service quality (Table 3-9).

Field testing allows a commission to determine for itself when and under what circumstances a company is or is not in compliance with certain standards, usually those concerning dial tone speed, call completions, transmission levels, subscriber loops, operator answer time and access to the long distance operator of one's choice when using a pay phone.

---

[12] Ibid., 21.

Overall, field testing is probably the most reliable method of determining the quality of a company's performance. It is also the method most demanding of a commission's resources. (See Appendix C for further discussion.)

CUSTOMER SURVEYS

The NARUC *Handbook* categorizes states by level of use of customer surveys and highlights two states that have incorporated such surveys into their new incentive regulation plans:

> While Minnesota has not utilized service quality surveys in the past, it will in the future as part of the quality of service monitoring under the incentive regulation plan recently approved for U S West. Under the plan, U S West will provide the Commission with the results of the Customer Satisfaction Measure survey on a quarterly basis. The Commission believes such reporting will allow it to better monitor service quality under incentive regulation.[13]

> The New Jersey Commission has utilized customer service quality surveys in the past as part of rate case proceedings. However, since the Commission has moved to an alternative form of regulation for New Jersey Bell, these surveys are utilized on a quarterly basis. The Commission staff analyzes the survey results to verify that the results remain above specified threshold levels. In the event the results fall below the designated thresholds, the Commission investigates and requires an explanation by the company.[14]

---

[13] Ibid., 29.

[14] Ibid. 29-30.

Although companies may value customer opinion surveys, the NARUC *Handbook* suggests that surveys are not the ideal method to measure service quality because:

> [Customer surveys] may be too subjective to be used as a tool for regulatory analysis. This is true since surveys reflect the customer's opinion or perception which may be influenced by other factors such as rate levels or rate structures. Often, survey questions and categories tend to be too broad to make them useful within the regulatory context. In this case if the categories are too broad, it will be quite difficult to pinpoint specific problems with service provision. Also, opinion surveys will not normally disclose a condition of "graceful degradation" of service.[15]

The most appropriate use of such surveys, states the *Handbook*, is as a tool for companies to internally monitor service performance. Nonetheless, interest in using direct customer assessments of company performance is on the rise. A direct focus on what customers want and when they are satisfied was being investigated by commissions in Kansas, Ohio, and probably others at the time of the NRRI survey.

Other Sources of Monitoring Information

The FCC maintains a service quality reporting system that commissions can use to supplement their own. Since 1995 quality of service reports have been included in the Commission's Automated Reporting and Management Information

---

[15] Ibid., 32.

System (ARMIS).[16] Bell operating companies and other large local exchange carriers subject to federal price caps are required to submit quarterly reports on installation, repairs, trouble reports, downtime, blocking and complaints. State regulatory commissions have access to ARMIS through an electronic bulletin board. Commission-ordered management audits are another source of information on company quality of service.

Enforcement of Standards

All commissions reported they can impose penalties for persistent quality of service deficiencies (Table 3-11). The two most frequent are show cause orders (24 states) and fines or reparations (20 states). A show cause order can have more serious consequences than fines since it opens the door to scrutiny by the commission of the company's records, rates and revenues. Such an action may also bring the company unwelcome publicity because it is required to appear before the commission and explain the failure to meet quality of service standards and say how it intends to improve future performance. The potential for rate case penalities was cited by 17 commissions. Other actions that commissions can take and that were mentioned by the survey respondents were revoking the license to operate (Colorado), a citation for contempt of a commission order (District of Columbia), and prosecution by the attorney general (Wisconsin). The respondents from Delaware and Virginia noted that the choice of action was at the discretion of their commissions.

---

[16] Jonathan Kraushaar, "Quality of Service Measurement," in *Quality and Reliability of Telecommunications Infrastructure*, ed. William Lehr (Mahwah, NJ: Lawrence Erlbaum Associates, 1995), 189.

TABLE 3-11

ACTIONS COMMISSIONS CAN TAKE WHEN LOCAL EXCHANGE CARRIERS DO NOT CORRECT SERVICE QUALITY DEFICIENCIES
(as of July 1995)

Possible Commission Actions	Commissions
Fine/Reparation	AL, AZ, AR, CA, CO, CT, FL, ID, IA, KS, MI, NE, NM, NY, OR, PA, RI, TN, VA, VT
Show Cause	AL, AZ, AR, CO, CT, FL, GA, IL, IA, KS, MA, MI, MT, NE, NH, NM, NY, OH, OR, PA, TX, VA, WI, WY
Rate Case Penalty	AR, CA, CO, FL, ID, IL, KS, NE, NV, NH, NY, OH, OR, TX, TN, VT, WY
Other	CO, DE, DC, NJ, OH, VA, WI

Source: NRRI Survey of Selected States, summer 1995.

In contrast to the number of commissions which can impose penalties, staff at only six commissions surveyed said they offer companies explicit rewards for their performance on quality of service: Alabama, Colorado, Florida, Nevada, New York, and Tennessee. Of these, only Florida has rewarded a company under the new standards. In Nevada, a company's past service performance is used to determine its return on equity when it chooses to move from ratebase regulation to some alternative form.

As discussed above, new or revised standards have often been linked to alternative regulation (Tables 3-6 and 3-7). Many commissions have created penalties and/or rewards for quality of service performance under alternative regulation. In New Jersey, Nevada, Oregon, and Virginia a company may be returned to ratebase, rate-of-return regulation if service quality performance is unsatisfactory. In four states, the amount of revenue available to the company through a sharing mechanism could be affected (Alabama, Colorado, Florida, and

Tennessee). For example, in Alabama, the amount of income the company can claim in the revenue/profit sharing plan can be increased or reduced depending on its service performance.

In four states, the price cap formula is tied to performance. In Illinois, for example, the formula for computing price changes under the 1994 price cap regulation plan for Ameritech-Illinois includes as much as a 2 percent penalty if the Company's service quality performance falls below existing standards.[17] Company performance is measured on eight criteria. If performance is below the established benchmark for one of the criteria the company is penalized by -.25 percent.

Four states which can reward service performance, Colorado, Florida, Tennessee, and Rhode Island, weight the company's performance and use this as an index in a predetermined formula either to calculate the company's share of earnings or the maximum price cap. Although the formulas and methods of calculating the final effects vary, in each of these states the company's performance is measured against standards and given a score. The scores are then weighted and combined for a final score on the company's overall performance. Table 3-12 shows Colorado's weighting scheme.

New York has established service quality performance criteria for both Rochester Telephone and Nynex. For Rochester, if service quality falls below the floor, penalties of up to .5 percent of local service and intraLATA toll revenues are assessed. In addition, dividend payments by R-Net to the holding company are to be suspended if service quality falls below the floor for traditional measures or if more than one surveillance level failure occurs in any one year. For Nynex, performance targets steadily increase over the five-year life of the plan for customer trouble reports, missed repairs, and service outages by market area (Manhattan, Greater Metro, and state). Low levels of customer complaints would provide a

---

[17] "Price Regulation Plan for Ameritech-Illinois Approved," *Telecommunications Reports* 60, no. 42 (Oct. 17, 1994) 16.

TABLE 3-12
COLORADO SERVICE PERFORMANCE MEASUREMENT PLAN

SERVICE QUALITY MEASUREMENT	Weight	1987	1988	1989	1990	1991YTD	1992	1993	1994	1995	1996
Maintenance:											
Total Trouble Report/100	20	1.99	1.79	1.89	2.18	2.29	1.75-2.3	1.7-2.2	1.65-2.1	1.6-2.0	1.5-1.9
Repeated Reports	10	NA	.22	.24	.31	.33	.25-.32	.24-.31	.22-.28	.21-.26	.19-.24
Wire Centers Over 8 RPHL in 3 months	15	NA	NA	NA	303	165	150/245	120/208	75/176	50/140	40/110
Customer Survey:											
Residence (CSM)	10	NA	NA	55	53	57	a	a	a	a	a
Business (CSM)	10	NA	NA	47	46	51	a	a	a	a	a
Provisioning:											
Held Service Orders (3)	1	54	206	672	867	1272	750-900	600-750	450-600	200-450	100-200
Switch Availability	5						99.998%-99.990% for each year				
Trunk blocking (USW-USW)	5	NA	NA	NA	1.6	2.0	1.0-2.0	.1.0-2.0	1.0-/2.0	1.0-/2.0	.7/1.7
Customer Access:											
Toll Calls	1	NA	NA	75.8	65.5	58.2	70/75	70/75	70/75	70/75	70/75
Directory Assist.	1	NA	NA	73.1	76.3	74.0	75/80	75/80	75/80	75/80	75/80
SBS Service Center	2	NA	NA	NA	22.8	26.1	17/22	17/22	17/22	17/22	17/22
SBS Repair	2	NA	NA	NA	87.7	89.1	85/91	85/91	85/91	85/91	85/91
Residential Service Center	2	NA	NA	NA	NA	NA	85/91	85/91	85/91	85/91	85/91
Residential Repair	2	NA	NA	66.9	66.9	66.9	83.7	85/91	85/91	85/91	85/91
TOTAL	100%										

[a] Customer survey measurement reflects historical information.

Source: Colorado Public Utilities Commission, *Regarding the Application of the Mountain States Telephone and Telegraph Company D/B/A U S West Communications, for Approval of the Rate and Service Regulation Plan,* Docket 90-A-665T, Decision C92-854, Exhibit A, May 26, 1992.

credit against penalties assessed for the other criteria. A customer satisfaction survey was to be developed. The plan provides for a review of service quality in the third year at which time the plan could be terminated if service does not meet target levels.

In the alternative regulation plan in effect in the District of Columbia, there are no financial penalties specified but companies are required to submit quarterly reports on 22 service quality standards as well as "explanations of failures to achieve thresholds for these standards."[18] The Commission also directed staff to analyze whether penalties should be instituted if the company fails to meet the Commission guidelines.

Of the 32 commissions surveyed, 16 had problems in enforcing standards, according to staff members. They cited:

- *Lack of staff*
- *Lack of enforcement*
- *Arrogant company behavior*
- *Weak enforcement by commission*
- *Incorrect information*
- *Vague standards*

Of the 32 commissions surveyed, 16 had problems in enforcing standards, according to staff members. The single greatest problem cited was lack of staff to monitor and evaluate companies' actions (eight commissions). Staff at four commissions indicated their problem was not having some means of coercing or enticing companies to comply with established standards. Staff at the other four commissions elaborated on this lack of enforcement leverage, citing situations such as arrogant behavior of companies, weak enforcement by commissions, incorrect or false information supplied by companies, and vague standards that are difficult to enforce.

---

[18] District of Columbia Public Service Commission, *In the Matter of the Investigation into the Impact of the AT&T Divestiture and Decisions of the Federal Communications Commission on the Chesapeake and Potomac Telephone Company's Jurisdictional Rates,* Formal Case 814, Phase III, Order No. 10483 (Washington, D.C.: District of Columbia PSC, Aug. 26, 1994), 37.

As of July 1995, staff members at six of the commissions in the NRRI sample reported having actually imposed penalties on companies for their performance under new quality of service standards: California, Colorado, Florida, Montana, Ohio, and Pennsylvania. In 1994, Colorado determined that U S West had not met its service obligations and, through a show cause order, imposed a penalty of $4 million on the company.[19] In 1993, Montana conducted an audit of U S West's service and found the company was out of compliance in certain geographic areas for installation, out-of-service repair within 24 hours, and timely telephone access to company personnel. Because the Montana Commission does not have fining authority, it filed against U S West in district court for fines of up to $1,000 a day per violation cited, of which there were over 80. The case had not yet been resolved at the time of preparation of this report, but the staff respondent expected it to be settled out of court.

Another mechanism available to commissions to encourage compliance and not discussed earlier is to request a company to submit a plan of action with accompanying dates that addresses the cited service deficiencies. The plan is then scrutinized by staff and commissioners to determine the potential for improvement within a reasonable time frame. Finally, if it is agreed to by the commission, some monitoring of the plan is usually specified. Staff at 16 commissions reported that they have requested plans to upgrade service quality and all of them are monitoring the company's progress.

Action plans offer a long-term solution to service problems. Commissions have also established standards for problems that must be addressed by companies immediately (see Table 3-13). These problems most frequently involve public health and safety. For example, all commissions specify the time frame in which out-of-service repairs must be made, particularly to emergency and safety services.

---

[19] "U S West Fined for Bad Service," *State Telephone Regulation Report* 13, no. 15 (Aug. 10, 1995): 14.

TABLE 3-13

CIRCUMSTANCES WHICH CAN TRIGGER AN IMMEDIATE EVALUATION OF A COMPANY'S SERVICE QUALITY (as of July 1995)

Circumstances	Commissions
Standardized reports submitted to commission	AL, FL, IL, MA, NH, NJ, OH, TX, WY,
Customer complaints	AR, AZ, CA, CO, CT, FL, IL, IA, KS, MI, MT, NE, NV, NH, NM, NY, OH, OR, PA, TN, TX, VA, VT, WI, WY
Certification of competitive local exchange carrier	DE
Major breakdown of system	DC, NE, NJ, NY, OR, PA, WY
Disaster	DC, RI

Source: NRRI Survey of Selected States, summer 1995.

Other problems for which immediate action is required are safety violations, aerial clearances, out-of-compliance installation timetables and trouble reports per 100 lines that exceed the allowed number.

COMMISSION RESOURCES

The NRRI survey included questions about commission resources devoted to telecommunications quality of service programs. The number of staff working on service quality appears to vary with the size of the commission and the population of the state. Commissions use several staff arrangements to respond to, evaluate, monitor, and tally inquiries and complaints from the public about regulated utilities. For the NRRI sample, in 21 states and the District of Columbia the same staff handle inquiries and complaints about all utilities, while in ten states there are staff

assigned specifically to handling telephone complaints and inquiries (see Table 3-14). Service monitoring is a catchall category that refers to those who perform field tests as well as monitor and analyze company reports. Although 18 of the participants in the NRRI survey reported that staff are assigned to monitor company reports and to field investigations, in seven of them that is only a portion of their work. In 11 commissions one or less staff is assigned to this form of monitoring.

Caution about assessing the number of staff devoted to monitoring companies' service quality performance is needed for two reasons. First, commissions have personnel in consumer services, engineering, and other divisions (such as accounting, auditing, and utility analysis) who are identified as performing some of these duties but may also have other tasks and would not necessarily be included in these totals. Second, the totals for staff assigned to telecommunications inquiry and complaint processing probably underestimates the staff time at commissions devoted to these activities because, as several respondents noted, everybody in their departments is available to handle inquiries and frequently does, although they are not counted in the manpower devoted to this commission function.

Impact of Service Quality Programs

Staff at 16 commissions surveyed, or half our sample, said they were satisfied that the standards were, overall, doing a good job. Staff at six commissions said the standards were not working well. The other ten respondents qualified their responses. Three said that evaluation of the standards' effect on the company was dependent on the specific company–some were performing well, others were not. Two staff members told the NRRI that while the performance evoked by the standards was not bad, it could be better. One respondent stated that a judgment of the standards depended on what service was being evaluated

TABLE 3-14

COMMISSION STAFF ASSIGNMENTS TO TELECOMMUNICATIONS SERVICE QUALITY (as of July 1995)

Type of Assignment	Commissions
Telephone complaints and/or inquiries only	AL, AR, CA, FL, KS, MI, NH, NM, TN, VA
Telephone, gas, electric, and water utilties complaints and/or inquiries	AZ, CO, CT, DE, DC, ID, IL, IA, MA, MT, NE, NV, NJ, NY, OH, OR, PA, RI, TX, VT, WI, WY
Telephone service monitoring (other than complaints/inquiries)	AL, CA, CO,* DC, FL, ID,* IL,* IA,* NE, NH,* NJ,* NY, OH, OR, PA, TN, VA,* WY.

* Part-time only.

Source: NRRI Survey of Selected States, summer 1995.

because while the technical performance was good the customer service performance was not. One respondent identified a need for standards that could be automatically adjusted for continuing technological change, saying these standards needed to be stricter than current ones and better monitored. One staffer suggested that there needed to be an examination of the relationship of service quality to consumer satisfaction to determine whether the level of service quality being required and provided is more than consumers want to pay for. Two respondents stated they did not have enough information to make a judgment on whether standards were effective or not.

Although expressed in a variety or ways, staff members from 20 commissions affirmed the value of standards, measurements, monitoring, and financial incentives to encourage companies to maintain or improve performance. (This does not imply that staff from the other 12 commissions would disagree.

They did not address this question directly.) Alan Taylor, Chairman of NARUC's Staff Subcommittee on Telephone Service Quality and Chief of the Bureau of Service Evaluation of the Florida Public Service Commission, when asked to evaluate Florida's system of service quality indicators, said:

> We believe [the system] is effective in tracking trends for each company by comparing past performance with current performance. It is also effective in comparing the company's self-reporting results with what our evaluators find. It helps the company and us to identify weak areas needing attention. It is also useful in comparing company to company performance on an historical and current basis. Companies have made many improvements as a result of weaknesses identified through the program. We believe our whole program is cost effective. Millions of dollars have been returned to consumers.[20]

The compensation was paid to customers for overcharges or for being without service and not receiving what should have been automatic rebates. Taylor noted that most of the overcharges have been made by interexchange carriers, so, he said, the cost effectiveness of Florida's program for local exchange companies is primarily in keeping service levels adequate to limit complaints and to ensure that the information highway extends into rural areas so that lack of adequate telecommunications services is not a detriment to economic development in any area of Florida. He said the program is also very effective in resolving complex complaints, especially those where the industry cannot agree upon who is responsible for a problem.

Although expressed in a variety or ways, staff members from 20 commissions affirmed the value of standards, measurements, monitoring and financial incentives to encourage companies to maintain or improve performance.

---

[20] Alan Taylor, e-mail communication, Sept. 27, 1995.

Problems and Opportunities

The NRRI asked respondents about problems and opportunities they perceived for their commission's quality of service standards. In answering this questions, staff members were in two almost evenly divided camps. In 17 commissions, revisions of quality of service standards were either currently taking place or planned within the next six to 12 months. Staff at these commissions were focusing on the upcoming possibility of changes when answering. Staff at the other 15 commissions were speaking from a position of working within a system where no major changes were anticipated in the near future. As a result of these different perspectives, the expressed concerns and opportunities range from the proactive to the contemplative to the reactive.

The concern cited most often, by staff at seven commissions, was that there was inadequate monitoring and enforcement. This was followed closely by staff from five commissions who are concerned about maintaining service quality as the network infrastructure expands and technology continues to change. Enlarging on this concern three commission staff expressed concern about how to monitor standards in the context of new technology. For example, one staff respondent mentioned that there may not be a need to monitor switches but there may be one to monitor resellers. Staff also expressed concern about how to fashion standards that would be flexible enough to respond to changing technology and competition. Finally, one commission staff member was concerned about the diminishing acceptance of state standards by multi-state companies.

The concern cited most often by commission staff was that there was inadequate monitoring and enforcement. Overall, commission staff saw opportunities to make changes, usually in the direction of making standards more stringent.

Overall, commission staff saw opportunities to make changes, usually in the direction of making standards more stringent. Staff at eight commissions saw opportunities to improve service quality by specifying quantitative standards, making existing standards more stringent and using financial penalties to punish poor service. Staff members at five commissions saw increasing competition as a way of improving service quality. They also suggested that competition in conjunction with new technology might provide a structure for updating and possibly eliminating some standards. One commission staff respondent, who characterized current monitoring and compliance as poor, felt current service quality would not be adequate for the more advanced services. This staff person saw an opportunity to collect information on company performance in order to determine what level of service the company is providing to various customer groups. A second respondent, who described the current standards as working well, also saw an opportunity to gather information about companies' performance and then use it to set benchmarks and educate commissioners. Lastly, one staffer saw an opportunity to develop a less adversarial and more cooperative relationship with telecommunications companies.

Of the 32 commissions surveyed by NRRI, 17 were planning revisions to standards within the following year (see Table 3-1). Of these, 13 reported problems with their Bell operating company meeting current service quality standards (see Table 3-5). Reasons given for revising current standards ranged from making them stricter to upgrading and modernizing language. The California Commission was reviewing standards with a view toward interconnection and automatic answering issues. The Colorado Commission was considering changing its weighting mechanism. Since U S West had no excess earnings in 1994 the Commission was unable to penalize the company through its incentive plan even though its service performance was below standard. The Tennessee Commission was planning a revision of the basic minimum standards, which have not been changed since 1971. One of the main reasons for this revision, according to the

staff respondent, is the need to upgrade technical standards to fit the capabilities of new technology. Wisconsin and Wyoming were both revising standards because of legislative mandates.

Conclusion

We have laid out the types of actions that commissions have been taking to protect consumers in the face of new forms of economic regulation and changes in the marketplace brought on by the technological revolution in telecommunications. One remedy for poor service quality that was not included in the 1995 survey is the effort of states in the U S West region to create a concerted policy response to the company's poor service quality. We will discuss that initiative in chapter 6, along with recommendations for improvements to service quality programs. Many states have revised their standards, often in conjunction with a plan for alternative regulation. Innovative weighting schemes and enforcement mechanisms are being tried. Yet it is noteworthy that only half the respondents to the survey reported overall satisfaction with their service quality programs. This suggests there is more to be done.

One area that was not broached in the NRRI survey is standards set by industry. Those standards are having and will continue to have a substantial impact on service/quality in telecommunications. In the next chapter we turn to an overview and analysis of general public and private roles in industry standard setting.

CHAPTER 4

SETTING TELECOMMUNICATIONS STANDARDS

Standards are increasingly used by consumers, service providers and commissions as one way to simplify a complicated world. If a consumer knows that a product or service meets a certain standard, he or she no longer has to do research to decide whether to make a purchase. Service providers also rely on standards to make purchase decisions and to make sure that their products and services will work with others. In telecommunications, the conditions necessary for achieving interconnection and interoperability are among the central issues facing private- and public-sector decision makers. In some cases, standards are a solution to problems like interconnection quality of service and the more traditional service quality issues. At the same time, incompatible or incorrect standards can cause problems for quality of service.

In this chapter we examine the role of the private and public sectors in the creation and implementation of standards. For the purposes of analysis, we create a distinction between technical standards and consumer standards. The key to this distinction is that time is the most important dimension underlying our assumptions about the nature and degree of regulation. Many of us assume a bright future for the telecommunications industry: higher productivity in the industry itself and for the American economy, lower costs, a wider degree of choice and perhaps more. We are all focused on the "time between" our present uncertainty and the realization of fully effective competition. For our purposes, "consumer-driven" standards are those standards

"Consumer-driven" standards are those standards for quality that can be measured and responded to in the short run. "Technical" quality standards reflect those decisions that have a longer-term impact.

for quality that can be measured and responded to in the short run by instituting fines and penalties, hiring more employees, changing company policy, or improving management. Put another way, these quality gains are realized by taking the existing technology and combining it with capital, labor and management to produce higher quality service in the short run. All of the standards listed in Table 3-8, for example, may be considered consumer service standards.

"Technical" quality standards reflect those decisions that have a longer-term impact. For the most part they are about the kinds of technology to design and purchase and the architectures to be developed. They cannot be changed in the short run to meet quality concerns because their consequences are so far-reaching, the capital commitments so large, and because those decisions are so intertwined with many others. Once technical decisions are made they cannot be reversed or modified to meet quality concerns; they set a direction and propel a service provider or an industry down a path and constrain the choices that can be made over a longer period of time. The benefit that this distinction provides is in making us realize that different people and institutions have different capabilities for gathering information and making decisions for the short run as opposed to the long-run decisions that must be made about quality. An overview of emerging issues in telecommunications service quality would not be complete without an introduction to problems in technical service quality, even if state regulatory commissions have more familiarity and influence with consumer standards than technical ones.

We will explore at length some of the general issues involved in setting standards, starting with the problem of identifying appropriate, adequate standards. In the next section we begin our examination of the problems and potential solutions in the creation and implementation of technical standards as they impact quality of service.

GENERIC ISSUES IN SETTING TECHNICAL STANDARDS

Quality of service, particularly reliability, but other dimensions like security and simplicity as well, is embodied in technical telecommunications standards. Deciding whether to define a standard typically begins with an engineering concern for whether an optimal one can be found. If a wrong standard is chosen, a company or a country may suffer the results for many years with high sunk costs in equipment and losses in productivity. Under this logic, no "official"[1] standards should be set. Instead, consumers in the marketplace should choose that system of technical standards which offers them the best bundle of services. If uniform standards were imposed, some users might be forced to compromise on the services they receive.[2]

A free market for technical standards, where choices are determined only by the economic interest of consumers and producers, clearly does not exist. In reality, equipment, software, and service providers decide on standards.

A free market for standards, where choices are determined only by the economic interest of consumers and producers, clearly does not exist. In reality, equipment, software, and service providers decide on standards. There is little to no consumer representation in standard-setting activities. Consumers do not directly participate in the standard-setting process for many reasons. The process is too technically complicated, too costly, and too many actors are involved in an already complicated process. The theory is that adequate representation of consumers is achieved through the competitive desire to render good service to meet consumer needs. Because a market approach to standards could not work,

---

[1] We use the term "official" to denote standards that are the product of public organizations, nonprofit organizations, and voluntary agreements among corporations to pick a particular standard as "their" standard. All organizations are public and consequently, there are always both economic and political interests involved (Barry L. Bozeman, *All Organizations are Public: Bridging Public and Private Organization Theories* [San Francisco: Jossey-Bass, 1988]).

[2] This is what the FCC has stated as its policy for ISDN (See, for example, FCC, *Integrated Services Digital Networks, First Report*, 55 R.R.2d 1107 [1984]).

consumers will always have to compromise, since ultimately one or only a few standards will survive the competitive process. Also, the proliferation of many different standards and technologies may mean local optimum solutions for some segments of society but high costs in interconnecting these technologies.[3] Some of these interconnection costs may not be affordable by all users, especially small- and medium-size businesses. With these many "islands of communications," interconnection of all users may not be feasible, resulting in public welfare losses affecting, among other things, the quality of service, the ability to do business, and the ability to provide universal service. For example, one of the reasons cited for why ISDN technology has not disseminated more quickly is the various versions of ISDN that are being implemented around the country. The same scenario is developing in the debate between proponents of time division multiple access, code division multiple access, and *groupe speciale mobile* as the new standard for wireless personal communications services.

There are many other equity and efficiency concerns in the standard-setting process. They permeate the process since standards permeate our lives: electric wall outlets are standard, car parts are not; telephone wall jacks are standard, housing and building codes are not. The choices about making an "official standard" have political and economic implications for the structure of industry, the level of competition, the locus of decision making, the choices consumers have, and the costs we pay (see Table 4-1).

Understanding the standard-setting process is important to policy makers because the technological standards that do emerge are not strictly technical decisions, but have implicit quality tradeoffs. According to Carroll,

---

[3] Stanley M. Besen and Garth Saloner, "The Economics of Telecommunications Standards," in *Changing the Rules: Technological Change, International Competition, and Regulation in Communications*, eds. R. W. Crandall and K. Flamm (Washington, D.C.: Brookings Institution, 1989), 177-200.

TABLE 4-1
BENEFITS AND DRAWBACKS TO TECHNICAL STANDARDS

Benefits	Drawbacks
Assure the safety and reliability of computer and communications products.	They may limit choices and force users into equipment that does not suit their needs.
Increase the opportunity for worldwide exchange of information.	Not everyone views standards as beneficial: Manufacturers may wish to keep a customer "captive."
Foster innovation by allowing new products and services to be built on the existing investments in experience, understanding, equipment and human skills.	Poorly-designed standards may inhibit innovation and "crowd out" better standards.
Allow smaller firms and nations to compete so long as their products are based on accepted standards (avoid cost of advertising and other marketing expenses).	Proprietary standards support anticompetitive practices by market leaders.
Reduce the need for "bridge" and "gateway" equipment to serve as translators between incompatible systems.	
Disseminate information (standards are themselves a store of information).	
Increase manufacturing efficiency through economies of scale, lower costs for uniform and interchangeable parts and advances in process technology.	
Foster international trade by facilitating exchange and increasing efficiency based on "comparative advantage."	

Source: Adapted from David Hack, *Telecommunications and Information Systems Standardization–Is America Ready?,* Report No. 87-458 SPR (Washington, DC: The Library of Congress: Congressional Research Service, 1987).

> ...(technical decisions) that become a part of the economic system have the same effects as law: an *authoritative or binding* expression of social norms and values from which the individual or a group may have no immediate recourse.[4]

Telecommunications standards have an authoritative and binding effect on society in a number of very important ways: establishing the cost of information both relatively and absolutely, influencing patterns of communication, encouraging the relative competitiveness of various industries, and determining the overall accessibility of information. This means that the choice of a technical standard should not only be judged by such technical values as avoidance of outages, transmission speed, and bandwidth but other values such as those stated in the Communications Act of 1934: "the public interest, convenience and necessity." For example, at one time, the international telephone numbering scheme provided for only a single digit country code for the United States, followed by a ten-digit telephone number.[5] If the Consultative Committee for International Telephone and Telegraphy (CCITT) were to have incorporated this scheme into its ISDN recommendations, a system of multiple networks within a country would be effectively foreclosed since only a limited number of carriers could be accessed. However, the CCITT adopted a fifteen-digit plan, thus eliminating a potential barrier to competition.[6] This is only one example of how technical standards have important policy implications. Clearly, constant vigilance is needed to examine how and what quality of service issues are at stake with the adoption of a particular technical standard.

---

[4] James D. Carroll, "Participatory Technology," *Science* (February 1971): 648 (emphasis added).

[5] Consultative Committee for International Telephone and Telegraphy, *Integrated Systems Digital Network,* First Report (CCITT, 1984), 1113.

[6] Ibid.

Private-Sector Promulgation of Technical Telecommunications Standards

While the problem of picking a technical standard begins with the engineering concern for picking the best one, the problem for producers and users is how to handle the *risk* of picking the wrong standard. This is because telecommunications standards are not only individual decisions; they are community decisions. In addition to devoting resources to researching the technically best standard for the organization, the user must devote resources to anticipating which of many competing standards will become the community standard. If a user picks the wrong proprietary standard and the proprietor discontinues a service or product, an organization's whole information technology infrastructure has been built without easy transition costs to the latest technology.

Technical telecommunications standards are not only individual decisions; they are community decisions.

Users may even have to buy the software and hardware of several competing vendors so they can hedge their bets as to which will become the industry standard. This means that a user will be extremely cautious in selecting a technology despite the immediate benefit in obtaining it. For example, for many years state government computer agencies have had multiple divisions to support IBM, DEC, and Unisys computer systems. No single vendor (standard) was chosen because of the concern about investing in the wrong technology. Either the state agency would pick a standard (that is, a company) that would not be innovative or go out of business, or the state agency would be trapped into buying only that company's products without the benefit of competition to keep prices down (but still suffering incompatibilities among the many systems).

Rather than speeding up innovation, multiple standards may actually slow it down. Again, the need to interconnect complicates the problem. If a user were only concerned about in-house communication, this would be a simpler problem,

but the uncertainty and risk escalate precisely because he or she must know what other users are doing in order to interconnect. David and Greenstein note that:

> (D)ecision[s] often are so technically complicated that only those who (*sic*) livelihoods depend on it can keep the complexity straight. Vendors know more about the technologies, but the debates often bog down in arcane technical issues that are inaccessible to many others, including some representatives of the user community.[7]

It is easy to see why a market would not develop and why political factors become important to consider.

Another way to understand the dynamics involved in creating standards is to distinguish four kinds: ratifying, anticipatory, proprietary, and incremental. Ratifying standards essentially are already being used and formally declared to be the standard for the industry. By contrast, anticipatory standards are created before actual products are designed and manufactured. The complexity and the time-urgency of the technology demands that we start designing the standard early. The hope is that standards can be developed so that industries and industry players can coordinate their efforts before a technology is developed. The coordination is sometimes slow and complicated. These anticipatory standards are always in a race with proprietary standards. Some manufacturers or service providers may not want to wait for an anticipatory standard, and instead, develop their own proprietary standard. Examples of anticipatory standards in the telecommunications industry are those for PCS and high-definition television. Incremental standards, like Transmission Control Protocol/Internet Protocol (which underly the Internet) do not involve any formal top-down planning approach like anticipatory standards. Instead, the Internet Society responds to immediate needs through a bottoms-up,

---

[7] Paul A. David and Shane Greenstein, "The Economics of Compatibility Standards: AnIntroduction to Recent Research," *Economic Innovation and New Technology* 1 (1990): 25.

grass-roots response. An issue of hot debate is which of these approaches is best suited for creating tomorrow's telecommunications infrastructure.

Voluntary Standards Organizations and Proprietary Providers of Goods and Services

In order to reduce costs and risk, both users and producers have formed VSOs to develop community standards. The VSOs are mechanisms for coordinating and planning their individual activities.

But standard setting through VSOs is also risky and political factors are important in explaining firm behavior as VSO members. Besen and Saloner observe that firms will attempt to have standards adopted by a VSO so that the firm can gain a market advantage for the technology based upon that standard and simultaneously prevent competitors from gaining an advantage at their expense.[8] Porter, writing about strategic management in business, has even advocated that firms consider the standard-setting approach as one way to gain a competitive advantage.[9] Noam points out with such a rapidly changing environment, standards could be used to establish stability and protect industry players from competition.[10] To really understand the formation of standards, therefore, it is necessary to be cognizant of the institutional frameworks and procedures rather than competitive market theory. "Markets" should be

Firms will attempt to have standards adopted by a voluntary standards organization in order to gain a market advantage for the technology based upon that standard and simultaneously prevent competitors from gaining an advantage at their expense.

---

[8] Besen and Saloner, "The Economics of Telecommunications Standards."

[9] Michael E. Porter, *Competition in Global Industries* (Boston: Harvard Business School Press, 1986).

[10] Eli M. Noam, "Toward an Integrated Communications Market: Overcoming the Local Monopoly of Cable Television," *Federal Communications Law Journal* 34 (1982): 209-256.

considered "integrated networks"[11] and "standards" are "integrated interdependencies."[12]

Through VSOs, individual companies have the option to enter into often long, protracted discussion with their colleagues on what standards to adopt. Usually "adoption" involves a VSO consensus vote where "consensus" means "no unresolved disagreements." Predictably, the process is slow because the effort is to make sure that procedural fairness is insured. The result is that it may take a long time before a standard is adopted. But companies are not required to participate in VSOs. They may strike out on their own and develop their own standards, hoping that their quick seizure of market share allows them to develop a "de facto" standard that replaces the efforts of VSOs. While there have been efforts to improve the standards process, participants from the information technology industry worry about the cumbersome and slow pace which hinders technological innovation[13] and allows more expensive proprietary standards[14] to crowd out the adoption of a public standard with its attendant network externalities.[15]

The lack of standards has even the chief executive officers of major information industry companies worried about U.S. competitiveness. The

---

[11] Peter Benson, "The Interorganizational Network as a Political Economy," *Administrative Sciences Quarterly* 20 (1975): 229-249.

[12] N. M. Reddy, "International Standardization of Technical Products," *Technovation* 10, no. 6 (1987): 407-417.

[13] Ivor Knight, "Telecommunications Standards Development: Why Standard Bodies Can't Keep Up With the Demand, and What Needs To Be Done," *Telecommunications*, January 1991, 28-42.

[14] Rather than being for public consumption (and bought at relatively small cost), proprietary standards could be more expensive since their use would have to be licensed and could be protected by trade secret, copyright, or patent law.

[15] D. Briere and B. Guptill, "The ISDN Conundrum: Is It Already Too Late?," *Network World* 8, no. 45 (Nov. 11, 1991): 1.

Computer Systems Policy Project in a recent report found that standards and standardization are "highly important" to the success of the telecommunications networks requiring immediate attention.[16] This has left producers and users of telecommunications services to fend for themselves.

Despite the significance of VSOs, there has been little empirical work done on the actual workings of these quasi-governmental organizations. Besen and Johnson and Weiss and Sirbu are notable exceptions.[17]

Besen and Johnson, in a case study of several broadcasting communications technologies, found that standards are more likely to be promulgated when (1) all the major actors are willing to participate in the standard-setting process, (2) the VSO anticipates potential antitrust problems in the design of its procedures, (3) the VSO somehow decreases the choices available in order to increase the chances for consensus, (4) the VSO uses objective measures to reduce subjective disputes, and (5) the VSO encourages the use of "side-payments" so that organizations whose standards are not adopted still can benefit from the standard that is adopted.[18]

Weiss and Sirbu identified institutional and process factors leading to the adoption of a standard. They found that the winning coalitions of players in the standards process tended to submit more technical reports in favor of their standard and tended to be educated by committee members from firms that were known to weigh market factors more heavily than technical factors. They also found that the larger the firm, the higher the probability of adoption of its standard. For example, when firms "support their efforts vigorously through written

---

[16] D. Crawford, "CEOs Unite to Influence U.S. Technology Policy," *Communications of the ACM* 34, no. 6 (1991): 15-18.

[17] Stanley M. Besen and Leland L. Johnson, *Compatibility Standards, Competition, and Innovation in the Broadcasting Industry* (Santa Monica, CA: The RAND Corporation, 1986); and M. B. H. Weiss, and M. Sirbu, "Technological Choice in Voluntary Standards Committees: An Empirical Analysis," *Economics of Innovation and New Technology* 1 (1990): 111-113.

[18] Notice that this factor is in potential conflict with the second.

contributions" it increases the probability of the adoption of a standard. This implies that firms that have the resources to persist in the standards process will be successful in having their standards accepted.[19] These studies indicate that nontechnical institutional and process variables play a prominent role in influencing the decision making process.

David and Greenstein suggest a few of the questions that still need to be researched if we are to obtain a better view of the standards process: (1) How are objectives set? (2) How do standards committees actually operate? (3) How do firms justify the expense in developing a standard? (4) Are there any biases in the decision rules and procedures utilized? And (5) what are the strategies used by different players and do they pay off?[20]

Firms that have the resources to persist in the process tend to be more successful than others in having their standards accepted.

This line of research suggests that decisions about standards are not only technical decisions but are, in fact, fundamentally political decisions. Political does not mean governmental. Instead, it is having access to, and influence on, the quasi-governmental agencies and organizations that make decisions about technical standards. As with any political decision, representation is critical to achieving a fair outcome. Yet, only a few organizations can participate in these discussions. According to one commentator:

> The lack of user participation at [technical planning] forums, as exemplified by leased circuit matters, is a matter of some concern....There is thus a danger that the

---

[19] While Weiss and Sirbu's work begins the process examining the factors affecting adoption of a standard, the level of analysis is too "macro." By summing over many different types of technologies and processes to find out what on average affects the adoption standard we miss the subtleties in the gaming of the standards process. We need to understand how these factors affect the decision making process if viable alternative procedures are desired.

[20] David and Greenstein, "The Economics of Compatability Standards."

> resultant arrangements may turn rather decidedly in favor of network interests.[21]

One way to increase participation is through the formation of user groups. Users and consumers do not participate in standards, in part, because of the high costs of organizing interests and attending these standards meetings. By forming user groups, these costs become more manageable. One successful example of how users and consumers have organized and made an impact on the standard-setting process is the federal sponsorship of the North American ISDN Users Group. Additional activities to represent consumer interests could be elicited by better answering the questions posed by David and Greenstein about how standards bodies actually operate.

While some VSOs suffer from moving too slowly, and their standards are subject to being frozen out by more quickly developed proprietary ones, the anarchic way in which standards for the Internet are developed has been criticized. The National Research Council, for example, argues that while the Internet Engineering Task Force (IETF) has been quite successful in having the Internet adapt to the needs of the moment, it does not have an overall vision of how the National Information Infrastructure (NII) will develop. The IETF approach works because solutions to a networking problem must be proven. But the National Research Council also questions whether the IETF will be as effective in the future when it does not have the guidance of a small "group of highly motivated researchers" and, instead, has a much larger constituency to work for, including a new set of rival commercial interests. The National Research Council argues for a middle ground between the slow and bureaucratic standards process found in government, the Institute of Electrical and Electronic Engineers, and the International Standards Organization, and the chaotic, incremental approach used

---

[21] Anthony M. Rutkowski, "The Integrated Services Digital Network: Issues and Options for the Future," *Jurimetrics* 24, no. 1 (1983), 20.

by the Internet Society. They recommend that government provide vision and leadership. One way to do this is through simply airing the public issues involved in building the NII. A second way government can provide leadership is through procurement, although this approach to influence outcomes will lessen as the government pulls out of financial support of the Internet. They suggest that before the government does completely withdraw financial support, it assure that its successor takes over planning for long-term goals that may be overlooked in the immediate rush to satisfy short-term interests. The National Research Council also suggests that the government continue to subsidize those parts of society that need help in becoming active participants in the NII, including to support research and primary, secondary and higher education. Finally, they suggest that the technical underpinnings of NII and the next generation Internet are a public good and that government should continue to provide research on the technical issues, as it did in creating the Internet.

Alliance for Telecommunications Industry Solutions

The organization that debates and decides on the standards for service over the public switched network has evolved over the last dozen years into one that includes, not just the local exchange companies, but their competitors. Up until the 1984 consent decree, AT&T established most of the hardware, software, and operational standards. With the implementation of the consent decree, local telephone companies formed the Exchange Carriers Standards Association (ECSA), a VSO for the telephone industry. The special focus at that time was to ensure that local and long distance communications continued to run smoothly. Other concerns included network security and reliability, billing formats and schedules, and telephone installation techniques.

ECSA membership was initially limited to the telephone companies although enhanced service providers, interexchange carriers, and end users had nonvoting

"participant status." Over time, ECSA has increased its scope and responsibilities and the number of committees and forums to deal with them. In 1994, following regulators' pressure for a more competitive, open process, the ECSA (now renamed the Alliance for Telecommunications Industry Solutions (ATIS) opened up membership to all "domestic providers who have an investment in switching and transport."

Following the publicity of several service outages, including AT&T's New York accident in 1991, the FCC established a Network Reliability Council (NRC) to provide advice and recommendations to the FCC on how to monitor and prevent future occurrences.[22] In 1994, in a response to the growth of the telecommunications industry, a new charter was created empowering the NRC to investigate:

1. The reliability of network services on a local and regional basis
2. Potential new risks from new or increased interconnection arrangements
3. Reliability issues with new services and technologies
4. Access to essential services during outages (for example, emergency service)
5. Whether and to what extent outages have disproportionate geographic or demographic impact[23]

One of the recommendations of the NRC was to establish the Network Reliability Steering Committee (NRSC) under the auspices of ATIS. The NRSC consists of representatives from the telecommunications industry, academics, and consumer

---

[22] Raymond W. Lawton, "Network Utilization Principles and Pricing Strategies for Network Reliability," in *Quality and Reliability of Telecommunications Infrastructure,* ed. William Lehr (Mahwah, NJ: Lawrence Erlbaum Associates, 1995), 146.

[23] Alliance for Telecommunications Industry Solutions, *Network Reliability Steering Council Annual Report* (Washington, D.C.: ATIS, 1995), 4.

organizations, and more recently from the cable television, satellite and personal communications industries. The NRSC collects information about outages, monitors trends, and produces reports for the benefit of the industry.

ATIS is modeled after the American National Standards Institute (ANSI), a nationally chartered formal standard-setting organization which coordinates and accredits the many standard-setting organizations around the country. ATIS' emphasis is on voluntary standards setting where consensus ("no unresolved disagreements") dictates whether a standard is formally adopted. ATIS is a "secretariat" and provides administrative support for the committees to ensure that they follow ANSI procedures (so that there are no problems with "due process"). Most of the actual work, however, is done at the committee level, especially the subcommittee level where the initial ideas for standards are introduced and developed. These subcommittees then bring their consensus standards to the full committees, where they are usually approved. Representation and work at the subcommittee level, therefore, is very important in understanding what standards are being developed and even more important, in influencing their design. As of this date, ATIS has grown to nine standing committees and fora:

- T1
- Carrier Liaison Committee
- Telecommunications Industry Forum
- The Information Industry Liaison Forum
- The Network Reliability Steering Committee
- Electronic Communications Service Provider Committee
- PEG Protection Engineers Group
- Standards Committee 05 Wood Poles and Products
- SONET Interoperability Forum[24]

Ad hoc groups are also formed to investigate salient issues or to coordinate standards work with other important standards bodies. For example, the Network

---

[24] Alliance for Telecommunication Industry Solutions, *ATIS 1995 Annual Report* (Washington, D.C.: ATIS, 1995).

Operations Forum created the Internetwork Interoperability Test Plan Committee to put together a Signaling System 7 network in laboratories across the country and is now conducting important tests to make it as reliable as possible. Bell Communications Research (Bellcore) has announced plans to market itself as an independent certification authority for telecommunications equipment. This may be an important step towards assuring network interoperability.

One of ATIS' mantras to encourage cooperation is that "absent ATIS, the FCC would micromanage as a result of its policy decisions."[25] At the same time, ATIS uses FCC credibility to enhance its own credibility and authority by also repeating that the "FCC has given formal endorsement to its open, problem-solving committees and forums and acknowledged the significant contributions ECSA has made in helping to solve many thorny operational issues without regulatory intervention."[26]

Some questions still remain about ensuring quality of service. No consumer interest groups have a visible and active participation in ATIS. Companies are assumed to consider quality in their business decisions and this is assumed to redound to customers. Government participation seems limited to making sure that 911 services and law enforcement issues are not compromised. Most of ATIS' energy is spent on emerging markets and ensuring that standards are in place or appear to be in place so that companies can begin investing in further research or products. What remains unclear is how much attention is paid to existing problems.

There are other questions about ATIS adequately representing consumer and user interests. One is whether little telephone companies have the same input and influence (and derivatively, their customers) as the large ones. ATIS is aware of

---

[25] Alliance for Telecommunications Industry Solutions, *ATIS 1994 Annual Report* (Washington, D.C.: ATIS, 1994).

[26] Exchange Carriers Standards Association, *ECSA 1992 Annual Report* (Washington, DC: ECSA, Circa 1992).

this issue and is publicizing its efforts to deal with it. Also, over the life of ATIS and ECSA there have been a number of attempts to expedite the standards process. How have they fared? What is the compliance with standards? What is the tug-of-war with proprietary standards? Are these standards bodies moving fast enough? What attempts have been made to include the consumer needs for quality service? What attempts have been made to include consumers in the process?

One way to look at the standards process is by seeing the telecommunications industry as a continuum from the standards set, to the equipment that is designed and manufactured, to the market structure that develops, and finally to the market itself, the actual exchange in which these services are bought and sold.[27] Up until now, policy has only been directed very late in the continuum–towards the prices and costs at which these services are bought and sold (for example, tariffs). Only limited, sporadic attention has been given to market structure (for example, the AT&T divestiture) because of the very high costs involved with such a dramatic restructuring. But focusing on this late portion of the continuum reduces the freedom which policy has to make an effective difference because the policy always accepts the standards and the equipment and services as given. Policy as it is now implemented has very little effect. Regulators in good conscience cannot make extreme demands because of the high political costs and the large investments in standards and infrastructure that have already been made. Government officials may want to consider the

One way to look at the standards process is by seeing the telecommunications industry as a continuum from the standards set, to the equipment that is designed and manufactured, to the market structure that develops, and finally to the market itself, the actual exchange in which these services are bought and sold. Up until now, policy has only been directed very late in the continuum.

[27] David Landsbergen, "Establishing Telecommunications Standards: A Problem of Procedures and Values," *Information and the Public Sector* 2, no. 4 (1992): 392-346.

possibility of intervening earlier in the process to make sure that standards setting actually reflects consumer interests.

Government Promulgation of Technical Telecommunications Standards

Given the public nature of some of the issues in standards setting, it is perhaps fair to ask whether there really is a role for government in the process. The popular conceptualization of government intervention is limited to one of direct regulation. This is the stuff of news reports and campaign speeches. By failing to see that government intervention can take on a variety of forms there is a reduced flexibility to craft specific interventions to effect policy goals.[28]

In considering the appropriate role for government in setting technical standards, it is important to remember that there are both market failures and government failures.

In considering the appropriate role for government, it is important to remember that there are both market failures and government failures.[29] David and Greenstein note that: (1) government may only have a short period of time to act before the market selects a standard and it is too costly to switch to another standard; and (2) government may also face the dilemma that when government agencies can have the most influence on the formation of a standard, they, like everyone else, have the least amount of information about what action would be most appropriate.[30] They also note that government intervention has its drawbacks. Some groups have more influence than others, especially when the

---

[28] Richard F. Elmore, "Instruments and Strategies in Public Policy," *Policy Studies Review* 7, no. 1 (1987): 174-186.

[29] Charles Wolf, "A Theory of Non-Market Failures," *The Public Interest* 55 (spring 1979): 114-133.

[30] David and Greenstein, "The Economics of Compatability Standards."

issues are arcane. Part of the difficulty is identifying all the parties who might be affected. Second, given the opportunity, political players will exaggerate the losses (because players are not required to demonstrate the intensity of their preferences by committing resources as they would in a marketplace). This is especially true when the gains and losses are in the future. Finally, there is a tendency towards incrementalism which leads to protection of old standards and avoidance of revolutionary new ones.

Many of the above principles, however, are based upon a conceptualization of government intervention as being limited to direct regulation. For example, the government could strongly influence standard setting by helping subsidize research in strategic areas. In addition, many of the problems with government intervention can also exist with voluntary organizations. David and Greenstein note that some groups systematically acquire more influence in both government and voluntary standards organizations.[31] Picking voluntary standards organizations or government intervention will not by itself solve the problem of finding the best way to develop standards.

In order to rectify this situation, government guidance of the standards process would have significant benefits. Perhaps aided by insights gleaned from a transaction costs analysis approach, government intervention can be selectively used to reduce transaction costs so that private parties can reach their own agreements.[32] For example, guidance may be limited to providing a reference model much the same as provided by ISDN and Open Systems Interconnection

---

[31] Ibid.

[32] Ronald H. Coase, "The Nature of the Firm," *Economica* (November 1937): 386-405; John M. Bryson and Peter S. Ring, "A Transaction-Based Approach to Policy Intervention," *Policy Sciences* 23 (1990): 205-229; Oliver E. Williamson, "Transaction-Cost Economics: The Governance of Contractual Relations," in *Organizational Economics*, eds. B. Barney and William G. Ouchi (San Francisco: Jossey-Bass, 1986); and Douglas D. Heckathorn and Steven M. Maser, "Bargaining and the Sources of Transaction Costs: The Case of Governmental Regulation," *Journal of Law, Economics, and Organizations* 3, no. 1 (1987): 69-98.

(OSI). Currently, the Japanese are using the OSI model to allocate telecommunications functions to their regulated and unregulated organizations.[33] The reference model would not specifically dictate what technologies should be adopted because the market is more suited to doing this. The function of the reference model would be to loosely state the goals and values behind a U.S. telecommunications policy and the performance standards needed to realize those goals. The benefit of this approach is that it frees up competition to direct its efforts away from the standard-setting process and towards the provision of quality telecommunications products and services.

Long-range technical standards are essentially beyond the purview of state regulatory commissions. An understanding of technical standard setting and its limitations is important, however. Furthermore, the technical expertise of commission staff might well be drawn on as representative of consumer interests.

Insofar as standards-based networks are a matter for government intervention, it is at the federal rather than state level. Long-range technical standards are essentially beyond the purview of state regulatory commissions. An understanding of technical standard setting and its limitations is important to them, however. Furthermore, the technical expertise of commission staff might well be drawn on as representative of consumer interests if user participation were instituted in industry standard-setting committees. And, in turn, commissions have much to gain by ensuring that they have staff who are well-versed in technical standards that may arise in review of interconnection agreements under federal telecommunications reform legislation.

---

[33] Rutkowski, "The Integrated Services Digital Network."

SETTING CONSUMER QUALITY STANDARDS

The second part of our analysis examines whether consumer quality of service standards should be promulgated, and if so, some of the considerations in creating and implementing these standards. Most state regulatory commissions have, of course, already promulgated quality of service standards, as extensively documented in chapter 3 and Appendix C. At issue here is not whether they should continue to apply customer service standards to regulated monopolies or the monopoly portions of partially regulated companies, but what the commission role is likely to be in the future with respect to consumer standards. Before commissions proceed down this road it might be useful to examine what obstacles other agencies have faced when they decided to create standards. We picked two case studies, the Occupational Safety and Health Administration (OSHA) and nutrition labeling, because some of the suggestions and situations now being discussed in telecommunications parallel those faced in these cases. The goal of this analysis is to examine history for categories of issues that may also turn out to be problematic if public service commissions decide to become involved in setting consumer standards for quality in the network of networks. We then move to a more general discussion of the strengths and weaknesses of the public and private sectors in setting standards. While the prior section focused on the unique problems faced in creating technical standards, some of the institutional issues discussed in this section could also apply to the formation of technical as well as consumer quality standards.

Public service commissions should look at what other agencies have faced as they decide whether to become involved in setting consumer standards in the network of networks.

Occupational Safety and Health Administration

The OSHA is one of the agencies most closely associated in the public mind with the worst of federal bureaucracy–numerous but arcane standards that result in high costs of compliance with little results, and sporadic and disparate enforcement. What is especially curious is how OSHA received this reputation when one learns that OSHA was mandated by statute to adopt already existing industry "consensus standards."

It is easy to see that instituting standards for all the workplace health and safety hazards to which a worker could be exposed would be a gargantuan process. For each industrial chemical, for example, a rulemaking agency would have to announce the intent to promulgate a standard, listen to industry concerns, and then issue a defensible rule which balances the costs to industry and the worker. The rule would have to be specific in detailing how much, how long, and under what conditions it applies, lest it be vulnerable to legal challenge.

Understandably, then, OSHA adopted consensus standards which were already in use by industry trade associations and research organizations. Of course, OSHA has latitude in how closely it would follow this authorizing mandate, but clearly it was in OSHA's perceived self-interest to adopt already existing industry standards, especially as a new agency which was seeking to make its mark. Other factors supported the strategy of adopting industry standards–OSHA would not need to rely on its scarce research budget, and the costs of enforcement would be low since there would be higher rates of compliance.

While OSHA would seem to have gotten off to a propitious start, several "landmines" were lying in wait. Because OSHA had a small budget and a small research arm, National Institutes of Occupational Safety and Health, they were not able to investigate the efficacy or the wisdom of these many standards. The result

was that many standards were adopted without proven benefits.[34] While OSHA was able to save money by quickly adopting wholesale existing industry standards, it turned out that many of them were not relevant across all industries. It also turned out that many of these standards were old, arcane, and too detailed. Industry self-regulation is just as prone to having outdated and irrelevant rules as government. For example, OSHA adopted industry rules which prohibited the use of ice in drinking water. Obviously this is seen as a crazy rule now; but it harkens back to the days when ice was obtained from frozen lakes and could have been contaminated. While it may be hard to see now why an agency might adopt such standards, executive agencies are pushed by their constituencies and the courts to be specific so that everyone knows how to comply with the law. To have these detailed regulations already specified by the agencies was viewed as a gift.

Another difficulty with these standards is that they were "design" standards rather than "performance" standards.[35] Rather than focusing on what level of chemical exposure an industrial worker could legally endure (performance standards), many of the industrial standards specifically detailed procedures and technologies to ameliorate the effects of chemical exposure. The prevailing bias was to promulgate "design" standards. That is, they specified "how" something was to be accomplished rather than the "performance goal" and then allowing the regulated entities to decide how to meet that standard. The assumption behind this approach is that by instituting specific steps, engineers could "design out" human error. While this may be more expensive, it is more likely to work. For example, instead of requiring workers to wear earplugs, engineers would rather rely on reducing the amount of noise that is emitted. Knowing human nature, the engineers believed workers would not wear earplugs and so they preferred to

---

[34] Phillip Harter, "A View from the OSHA Task Force: Voluntary Standards Used in Regulation," *ASTM Standardization News* 5, no. 5 (May 1977).

[35] Stephen Breyer, *Regulation and Its Reform* (Cambridge: MA: Harvard University Press, 1982).

design out the noise. Applying this notion to telecommunications, the same logic would go into the design of quality of service standards. Rather than relying on managerial or worker competence, an engineering approach would design a technology or system that would be less prone to fail, though it may be more expensive. Many of the problems in network reliability have been blamed on managerial error. Engineers would argue that there are ways to reduce this error by designing appropriate engineering systems.

Obviously, design standards incorporate information on one way to solve a problem. If a company follows the standards it is relieved of knowing for sure whether and how the standard reduces risk. The same would be true for consumers. Where the design standard happens to incorporate the best technology and yields the lowest cost to industry, OSHA would solve significant information and research problems. The companies would institute the standard and be insulated from liability. However, in an environment where the costs and benefits of a particular approach to saving lives are unclear and the technologies are constantly changing, the necessity of having a fixed standard comes under question. Industries begin to complain that they have reduced freedom and thus are limited in their ability to flexibly respond and minimize costs. The opposite argument is that standards have bound up within them much information because of experience, research, and testing; in fact, much more information than can be expressed by a simple goal model.

What is especially curious about OSHA's reputation for arcane standards is that the agency was mandated by statute to adopt already existing industry "consensus standards."

Given the choices between these two approaches, OSHA's early strategy was to adopt industry design standards. This led to charges that its rules were costly and ineffective. Since the Carter Administration, OSHA has moved from a design standard approach to a performance standard approach. Although the move from a design approach to a performance approach occurred beginning with the

Carter Administration, elements of the former still exist, as does the general reputation (fair or unfair) of OSHA regulation for being out of touch.

NUTRITION LABELING

An alternative approach to the adoption of specific standards is to require industry to publish information about their products or performance. The assumption here is that by providing this information, consumers can choose that level of quality/cost which best serves their needs, rather than having an agency mandate a specific standard that might require quality/cost that is too high or low. More pointedly, the assumption is that the consumer knows what to do with the information once he or she receives it.

In 1974, the FDA required nutrition labeling on food which contained added nutrients or whose advertising made nutritional claims. All other foods, however, could voluntarily comply with a nutrition labeling program. This complemented legislation already in existence for eight years that required food producers to facilitate the nutritional and value comparison of food items.

In the late 1980s, a growing body of research reports and scientific evidence began to indicate the importance of diet in such chronic diseases as heart disease and cancer. Food processors took advantage of this research and began to make many kinds of claims about the health benefits of their products. Unfortunately the health and nutritional claims still confused consumers. The primary problem was a lack of standardized information which would allow for easy comparisons.

On May 8, 1994, a new mandatory nutrition labeling program went into effect. The Nutrition Labeling and Education Act of 1990 administered by the Food and Drug Administration required that food processors provide information on fourteen nutrients and clearly state serving sizes. The goal of the legislation was to allow consumers to make direct comparisons of the nutritional value of different

foodstuffs without having to take into account different serving sizes or the different terms referring to the health claims about a particular foodstuff. Also, the health claims of different foodstuffs in preventing or reducing the risk of chronic disease had to be scientifically verified. While it is still too early to tell whether the act will have a positive impact on the American public, an early survey conducted by Prevention Magazine and the Cable News Network found that the new label "helped improve the overall quality of their diet."[36]

Public service commissions may want to consider a "service quality" labeling program if they believe that consumers are currently not receiving accurate information on the prices that they would pay for the services provided by different companies or on the quality of service they would receive.

The Role of Public and Private Sectors in Setting Consumer Standards

In reviewing both the private- and public-sector standard-setting processes, it is clear that each institution has its respective weaknesses and strengths. Identifying them and understanding why they exist would go far in enabling public service commissions to make decisions about whether and how they might become involved in the standard-setting process. While there are some general tendencies–for example, the public-sector standard-setting process tends to be less efficient–it is important to know that there are exceptions. Sometimes private-sector activities are just as encrusted with procedures and diverse interests as in the public sector. Knowing the exceptions provides clues to how we might improve the performance of each sector. In any event, in deciding upon an ideal standard-setting process, public or private, we should move beyond the question of which sector does better by asking the question, "How can these respective

---

[36] *Food Labeling News* 2, no. 45 (Aug. 11, 1994): 1064.

institutions complement each other to provide good quality standards?" This provides even more opportunities for solving the quality of service problem since it more clearly reflects what really happens.[37]

General Differences

In *Setting Safety Standards: Regulation in the Public and Private Sectors,* Ross Cheit provides a comprehensive discussion of some of the general differences between public and private-sector efforts at setting standards (see Table 4-2).[38] According to Cheit, public-sector standards setting is generally viewed as political, reactive, corrective, and subject to high legal and procedural formality. Public standards setting is also more likely to use compliance deadlines, require the use of unproven technologies, and regulate in a manner that interferes with traditional notions of managerial discretion. Private-sector standards setting is viewed as decentralized, adaptive, and market-based, with much lower standards and little opportunity for effective enforcement.

There are additional differences between the public and private standard-setting process. The public sector tends to have less technical knowledge than their private-sector counterparts–they tend to be lawyers, not engineers.

---

[37] Breyer notes that it is misleading to believe that standards setting is all based on rational, cost-benefit analysis either on the public or private side. In his review of National Highway Traffic and Safety Administration's dealing with automobile and automobile parts manufacturers, the search for a standard is an iterative, back-and-forth dialogue between the public and private sectors which is very dependent on precedent and continual renegotiation. (Breyer, *Regulation and Its Reform.*)

[38] Ross Cheit, *Setting Safety Standards: Regulation in the Public and Private Sectors* (Berkeley: University of California Press, 1990).

TABLE 4-2

COMPARISON OF PUBLIC- AND PRIVATE-SECTOR STANDARDS SETTING

	Public Sector	Private Sector
Information	Can justify collecting information as providing a public good	Individually possesses the information but no incentive to collect across industry
Decision Making	Tends to use legal expertise at the expense of technical expertise	More technical expertise
	Often cost-benefit justification is post-hoc	No VSO cost-benefit analysis required, nor done.
	Better in-house testing	In-house testing too expensive
Nature of the Standards	More strict	Less strict
	More likely to insist on unproven technologies	Less likely to insist on unproven technologies
	Corrective and reactive to emergency	Incremental and adaptive
	Require compliance deadlines	Standards adopted when it makes sense economically for company to do so
Procedures	Stricter legislative procedures in issuing standard–with participation inclusive of many more interests	Less strict procedures, not required to include all groups. Participation is limited to those groups which have an immediate economic interest in the standards
	Standards often challenged in court	Standards rarely challenged in court. Only concern is charge that standard is in violation of antitrust law.

Source: Adapted from Cheit, *Setting Safety Standards,* 1990.

When it comes to obtaining information, the public sector tends to acquire more statistics on real-life accident, error or failure rates. This costs too much for the private sector and the public sector tends to have better developed systems for collecting information. The information collected to support private-sector standards setting is largely anecdotal. Even the Underwriters' Laboratories relies on "clipping services."

One reason why there is a discrepancy is that this kind of information is really a public good. Since private-sector standards setting is typically decentralized, there is no way to spread the costs of collecting and analyzing data. This makes the information even more of a public good and explains why no one individual company or organization seeks to provide it. Second, if a company were to collect this information, it would now be held to a higher standard of behavior and could be requested to furnish the information in a court of law.

Public-sector standards setting is generally viewed as political, reactive, corrective, and subject to high legal and procedural formality. Private-sector standards setting is viewed as decentralized, adaptive, and market-based, with much lower standards and little opportunity for effective enforcement.

While it may seem that one role for the public sector is to collect information, it turns out that actually doing so is the central problem for agencies interested in setting standards because they have great difficulty in finding good, trustworthy sources. Clearly, most of the information is in the possession of industry, and industry understands that it can use what it knows to influence what issues are discussed and in what detail.[39] Consequently, industry will use information as a way to bargain with an agency. Should the working relationship between the agency and industry become adversarial, it becomes even more difficult to obtain information. The responses to agency requests become short and minimal, and

[39] Breyer, *Regulation and Its Reform*.

obtaining the right answers depends on knowing the right question to ask. If the agency decides to proceed without all the information, it risks technical criticism from industry later in the process.

Another component to standards setting is testing and applied research and development. This is a good substitute for actual experience. Both public and private sectors tend to have in-house capabilities, but Cheit tends to think that the government does a better job.[40] This is because research is expensive. Also, private-sector standards setting relies on its members to bring them information. Like the collection of experience data, doing applied research and development and testing seems to have public good characteristics. The one disadvantage is that public research is susceptible to budget politics.

Paradoxically, while public standards bodies typically have much better information systems in place, they are usually reactive. Standards need to be adopted while there is time and precious political focus.

Paradoxically, while public standards bodies typically have much better information systems in place, they are usually reactive. Standards need to be adopted while there is time and precious political focus. Often the attention is prompted by some kind of injury or accident. Generally the standards adopted under these circumstances are one-time corrections and narrowly focused. Technical issues are generally avoided for softer legal issues like the size of a label. But with public demands for action, government is willing to do things the private sector will not–protect people against their own mistakes, for example, by "pushing" new unproven technologies–and in some cases it is successful. Meanwhile, some private standards–writers do not know when a problem exists. At other times, they do not agree that the problem should be addressed. When changes are made, they are most likely the result of either government information

---

[40] Cheit, *Setting Safety Standards.*

or anecdotal evidence. Private standards are rarely unreasonable, however, in the sense of requiring something that is not generally feasible both technically and economically.

Finally, the formulation of standards must anticipate enforcement problems. Because enforcement has to work through the legal process, standards must be "objective," meaning that:

> [T]ests to determine compliance must be capable of producing identical results when test conditions are exactly duplicated, that they be decisively demonstrable by performing a rational test procedure, and that compliance is based upon the readings of instruments as opposed to the subjective opinions of human beings.[41]

Problems With the Private Sector Setting Standards for Itself

When we attempt to compare the standard-setting procedures of private sector and public-sector approaches, we may question whether the checks and balances that are intrinsic to our system of government also apply where business is allowed to set the standards which apply to them. Most people fear that where private business creates its own rules, the rules tend to be more lenient, be the product of procedures which are less formal, and, therefore, offer less procedural due process than an open process conducted by government agencies. Without this procedural protection, it is argued, business tends to create standards which are beneficial to itself or particularly strong business interests at the expense of consumers, less powerful business interests, and the general public.

---

[41] Breyer, *Regulation and Its Reform*.

Cheit argues that his case studies show that these fears and concerns are not *always* well-founded. He argues that there are strong business interests which could counter the tendency of a particular business interest to dominate a standard-setting body. For example, gas utilities will not install an appliance unless it complies with safety standards and J. C. Penney will not buy products unless they are certified by Underwriters' Laboratories. It should be noted that while these are logical possibilities, the extent and method by which these pressures are brought about, one industry on another, are not well understood. More important in prodding industry to act are threats of legislative or public agency involvement in standards setting. The most important, however, is the threat of lawsuit. By setting industry standards, companies can avoid damaging liability suits by arguing that they followed industry standards and therefore avoid claims that they did not meet a certain standard of behavior.

Strong business interests may counter the tendency of a particular interest to dominate a standard-setting body. And private administrative procedure is similar to the public sector's in trying to achieve the administrative law norms of notice, comment, and appeal.

Cheit found that private administrative procedure is similar to the public sector's in trying to achieve the administrative law norms of notice, comment, and appeal. These same means to achieving checks and balances in the administrative state also govern the operation of private-sector bureaucracies.[42] Instead of being accountable to a legislature, however, these private-sector bureaucracies have the threat of Federal Trade Commission, FCC, or Justice Department involvement. Private-sector agencies are very interested in ensuring due process or at least the appearance of due process.

---

[42] Cheit does not go into detailed analysis. Instead, he merely says, for example, that notice is present in both the private and public sector and leaves it at that. More detail on adequacy is wanting.

For example, committee membership is subject to rules on "domination" and "balance." In some cases, Cheit argues, the private sector does more to protect against domination than the public sector. The American Society for Testing and Materials even pays groups to participate (which has been discontinued in the public sector). But Cheit also says that "balance" looks better on paper than in reality. The claimed balance is at the reviewing stage, not the writing stage, so it is often too late to make significant changes or amendments. The real work is done by technical committees or individual engineers who work continuously at the subcommittee level. Another problem is that the categories used to ensure balanced representation by various interests are crude and therefore not very indicative of whether there really is balance. The problem is worse with consumers. Everyone is a consumer. In reality, United Laboratories and some ANSI-sponsored committees pay lip service to "consumer participation."

Cheit thinks that consumers have a better chance to comment on the private side than on the public one, contrary to intuition. ANSI mandates a rule similar to the Administrative Procedures Act (APA) as part of a general requirement that private standards reflect a "consensus" of affected interests. There is more direct dialogue in private-sector proceedings. Under the APA, hearings are optional. Also, there is more likelihood of direct contact between decision makers and their constituencies in the private sector than in the public sector. In both the public and private sectors, attorneys curb what could be reasoned responses to protect the agency or company from public reaction.

However, with the growing recognition of the importance of standards, the number of appeals has increased, as have challenges to committee membership in private-sector standards organizations. This would tend to offset the ability of the private sector to conduct less formal proceedings, which allow for more informal contacts to be made and agreements to be made more easily.

Conclusion

One of the main theses of this chapter has been that both market and political forces are important in shaping the creation of technical telecommunications standards. A few empirical studies have shown that company size and the level of participation are important predictors *over and above* the technical merits in the adoption of a standard. What still remains to be determined is how these and other political factors affect the adoption of a standard. How can the performance of VSOs be improved (for example, by insulating them from antitrust actions in research and development consortia, much like manufacturing companies have reduced antitrust liability) should they decide to develop in-house research to investigate compatibility or performance? The goal here is to make VSOs more efficient so that less costly public standards can be developed instead of more expensive proprietary standards

More generally, a trend towards semipublic or quasi-governmental solutions to public policy problems suggests that analysis of the public role of private standard-setting organizations (whether technical or customer service) is timely. Such "sector blurring"[43] is likely to exacerbate confusion over public and private responsibility for legitimately creating standards. It is, therefore, critically important to gain a clearer understanding of the processes and factors by which standards are created.

Given the general discussion on technical and customer standard-setting issues, it is clear that there is a role for both the private and public sectors.

Given the general discussion on technical and customer standard-setting issues, it is clear that there is a role for both the private and public sectors. State regulatory bodies do not now have the expertise and the resources to become actively involved directly in the setting of technical standards. However, there are

---

[43] Bozeman, *All Organizations are Public.*

other roles for government. Cheit, for example, sees two roles for public-sector standards organizations: promoting public values and working in niches that the private sector would not otherwise occupy. In some cases, the private sector will not venture into standards setting. If one accepts the premise that the private sector is better than the public sector in setting standards, one would relegate government standards setting to only those situations where the private sector would choose for economic or competitive reasons not to engage in standards setting. Where such gaps do exist, government guidance, both federal and state, would be well worthwhile even in the intermeshed network. There is a long line of literature to suggest that industry self-regulation is not necessarily efficacious.

This chapter has dealt with institutional issues in setting standards for quality of service. In the next we will turn to the economist's perspective.

CHAPTER 5

MARKETS, REGULATION, AND QUALITY INCENTIVES

In general, monopoly provision of telephone services under traditional, ratebase, rate-of-return regulation offered very high service quality. In fact, it may at times have provided more reliability, availability and assurance than consumers really wanted, but with limited flexibility and choice. The development of competition in a vastly changed telecommunications industry is expected to give customers much more of the kind and level of quality they desire. A major purpose of this chapter is to explore how the degree of competition present in a market affects incentives to provide quality of service. We then examine how rapidly changing means of economic regulation, particularly the transition to price cap regulation, may affect quality.

How Competition Affects Service Quality

As Adam Smith clearly articulated over 200 years ago, the social benefits from competition are derived from individual self-interest.[1] It is the pursuit of self-interested desires by individuals and groups of individuals known as firms that drives the engines of competition. On the production side, competitive firms are constantly seeking ways to lower cost, freeing scarce resources to be used in other activities. On the demand side, competitive firms seek ways to make their output more attractive to customers. The best known way to make an individual firm's output more attractive than the output of competitors is to lower price. In a

---

[1] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations,* ed. Edwin Cannan (New York: The Modern Library, 1937).

perfectly competitive market, then, price is driven down to underlying production cost, thereby maximizing the social benefits of production.[2] Price, however, is only one of several dimensions along which companies compete.

Modern industrial organization economists have analyzed the strategic and competitive choice of several variables other than price. For instance, advertising expenditures, capacity investments, and product differentiation are all ways in which firms pursue strategic advantage. Clearly, the choice of service quality and the array of service quality options falls in the set of strategic variables available to companies. The degree and form of strategic interaction between firms is affected by the overall structure of the industry. Conversely, industry structure can be influenced by the use of strategic variables. Unlike simple one-dimensional price competition, strategic use of some variables does not always benefit customers. Indeed, some strategic activity is meant to thwart potential competition.

Most economists are likely to agree that increased competitiveness will generally lead to greater industry activity and experimentation with new quality levels. When competing along a single dimension of quality, an individual rival has a profit incentive to target customers' quality desires, making its product relatively more attractive. When the average consumer is willing to pay the incremental cost of quality improvement, an individual company can enhance its profit by supplying the quality demanded. These individual gains tend to be transitory in a competitive environment, however, because rivals follow suit by matching quality offers. Competitive forces turn transitory gains into gains for society as quality and price mirror underlying demand and cost.

Companies may attempt to differentiate their product from rival products by altering quality. This behavior provides customers with additional choice in the market. Not only does a competitive market offer several providers from which to

---

[2] In actual markets, price competition is, to some degree, imperfect. Indeed, certain pricing strategies may limit competition or drive rivals from the market.

choose but several substitute products with different quality levels. Assuming tastes and willingness to pay for quality vary across customers, product differentiation can be socially beneficial as a greater variety of customer types is served. One potential drawback, suggested by a theoretical model developed by Salop, is that free entry may lead to more product variety than is socially desirable.[3] However, this should not be construed as a rationale for monopoly protection when natural monopoly conditions are not present, since monopolies with no threat of competition tend to undersupply variety.

By increasing the variety of services and array of quality options it produces, a single company may successfully limit the number of competitors. Such a strategy is known as brand proliferation. Brand proliferation by incumbent companies can remove profitable entry opportunities for potential rivals, thereby limiting customer benefits from the free market and biasing industry structure toward a multibrand monopoly.[4] Indeed, firms have been formally accused of using multiple brands as a barrier to entry. In 1972, the FTC charged the four largest ready-to-eat breakfast cereal companies with antitrust violations that included conspiracy to prevent competitive entry through the use of brand proliferation.[5] Saturation of the market with several brands or types of cereal is likely to make entry by a potential producer unprofitable because of a limited number of customers, not to mention grocer shelf space. Customers may benefit from brand proliferation

A protected monopolist has little incentive to fully respond to customer demand along quality dimensions or serve the wide variety of customer preferences.

---

[3] Steven C. Salop, "Monopolistic Competition with Outside Goods," *Bell Journal of Economics* 10 (spring 1979): 141-156.

[4] Jean Tirole, *The Theory of Industrial Organization* (Cambridge, MA: MIT Press, 1988), 285.

[5] Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization*, 2nd ed. (New York: Harper Collins, 1994), 313.

through the increased variety. When such a strategy prevents potential entry, however, the overall customer effects of brand proliferation can be negative. Some observers worry that regional Bell operating companies are following such a strategy and that competition will be accordingly slow to develop.

Even with the potential negative aspects of certain quality strategies, customer quality preferences are generally better served when competitive entry is allowed. A protected monopolist has little incentive to fully respond to customer demand along quality dimensions or serve the wide variety of customer preferences. Forcing monopolists to contend with potential entry is likely to lead to improved customer service, service variety, and overall customer welfare. Potential misuse of quality strategies is an issue that may be handled by antitrust enforcement or regulatory oversight.

Limits to Competition: The Role of Information

Arguably, the most important assumption in the economic model of perfect competition is the absence of information deficiencies. Indeed, most market failures can be traced to inadequate information. Without perfect information, investors are likely to devote inefficient resource levels and consumers may demand suboptimal product levels. Asymmetric information among groups of investors, among producers, or between producers and consumers can exacerbate inefficiencies in the marketplace. The importance of information in decision making and economic systems has led to the development of a field of study known as information economics.

One body of literature in information economics investigates market provision of quality. Greatest attention has been given to the case in which consumers have relatively limited information on product quality. Carlton and Perloff emphasize five limitations on consumer information:

1. Variation in information reliability
2. Costs of information collection
3. Limitations on how much consumers can remember and readily recall
4. Use of simplified rules to process information
5. Inability to process information correctly due to insufficient education or intelligence[6]

Telecommunications customers often have less information about service quality than do the producers. Such information asymmetry leads to particular market inefficiencies or failures. The well-known analysis by Akerlof of what he called the market for "lemons," demonstrates how asymmetric information can cause certain markets to become nonexistent or lead to lowest quality production.[7] To illustrate the Akerlof problem, consider a hypothetical market for cellular telephones in which half the telephones available are of "poor" quality and half are of "good" quality. Suppose consumers value poor quality phones at $50 and good quality phones at $100. If customers do not know the true quality prior to purchase, the willingness of a typical customer to pay for a randomly selected telephone is $75 = (½ × 50 + ½ × 100). Thus, the consumer is willing to pay more than the true value for a phone of poor quality ($75 > $50) because the phone may actually be good (with probability 0.5). However, the customer is unwilling to pay the full value of a good quality phone ($75 < $100) because the phone may actually be

Telecommunications customers often have less information about service quality than do the producers. Such information asymmetry leads to particular market inefficiencies or failures.

---

[6] Ibid., 555-557.

[7] George A. Akerlof, "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics* 84 (1970): 488-500.

poor. Given this market scenario, there is no incentive to produce or sell good quality cellular phones since the market does not reward it with a higher price. Because no good quality phones are produced, consumers know they are getting poor quality and are only willing to pay $50. The result: poor cellular phones drive good phones from the market. Limited customer information eliminates the market for good quality cellular phones.

Though the above result is insightful, Akerlof's model is overly simplistic in that it does not allow a role for the aspect of quality we called "assurance" in chapter 2, which can manifest itself both in initial product and firm reputation and in individual experience through repeat purchases. There may also be an incentive for high-quality suppliers to provide customers with information or signal high quality through a warranty offer. These strategies may attenuate the Akerlof result. If information can be made symmetric, then both high- and low-quality products are likely to exist in the market.

Carlton and Perloff highlight six potential solutions to the asymmetric information problem.[8] First, government may require sellers to make disclosures about their product. An example is nutrient labeling on most processed foods. Second, as already mentioned, *credible* guarantees or warranties provide a means by which sellers of high-quality goods signal information to consumers. Third, liability laws provide consumers recourse when producers fail to provide adequate quality. Recourse in the courts, however, is an imperfect solution because of potentially high transaction costs. Fourth, firm reputation is important to future profitability and provides a check to low quality when customers are expected to make repeat purchases. Fifth, some third party, an "expert," may facilitate the availability of information to consumers. This disinterested party could be the government or a private group such as Consumers Union, which publishes *Consumer Reports*. Expert opinions published by private outside groups are rare

---

[8] Carlton and Perloff, *Modern Industrial Organization*, 562-565.

because, as observed by Carlton and Perloff, information, once published, becomes an unprofitable public good. Published information is readily available to all at zero or nominal cost. Finally, the government, consumer groups, or industry may provide information by establishing standards and indices to measure certain quality characteristics. For example, the FCC has improved the information available to telephone customers away from home or office by requiring payphone and hotel telephones to be labeled with the presubscribed carrier's name and instructions on how to reach other competitors.

How Market Power Affects Service Quality

An analysis of ways in which industry market power may distort quality levels serves to confirm that, under certain circumstances, direct quality regulation or incentive regulation that corrects for improper quality tendencies may be appropriate.

Economists are quick to acknowledge systematic price-output distortions when firms enjoy some degree of market power. Far less appreciated is the potential for market power to manifest itself as service quality distortions. The conventional definition of market power (the ability of a firm to set price profitably above marginal cost) could be extended to encompass the degree to which the firm can profitably select service characteristics that diverge from competitive levels. The underallocation rule for monopoly output, however, does not always carry over to the service quality case, making policy analysis and prescription somewhat difficult. Under certain circumstances, market power can actually lead to the over-supply of quality relative to the socially

An analysis of ways in which industry market power may distort quality levels serves to confirm that, under certain circumstances, direct quality regulation or incentive regulation that corrects for improper quality tendencies may be appropriate.

desirable level. Despite this general ambiguity, we can identify circumstances under which there exist clear expectations for quality behavior.

That regulated public utilities may have a tendency to distort quality will come as no surprise. Regulatory commissions and their staff are frequently confronted with quality of service problems. In this section we provide a theoretical explanation for why companies that are free to select service attributes but are not subject to adequate competitive pressure will tend to: (1) distort service quality levels, (2) engage in a form of discrimination in which low-demand (low-end) customers are supplied with sub-optimal quality, and (3) provide less variety in the services they offer. Without competition or other quality controls and incentives, the firm has the flexibility to maintain a "take it or leave it" policy toward customers. "Captured" local exchange customers must either accept the service quality and inefficient variety of service options offered by the monopolist or simply not consume at all.

Ambiguous Quality Effects of Market Power

When regulatory action prevents profitable competitive entry by firms (either through a direct prohibition or indirectly through prices constrained below competitive levels), local exchange company market power over quality is likely to be high. The direction and degree to which a monopolist will use its market power to distort quality components depends on the way in which these service characteristics affect customer demand. To develop a theoretical understanding of the monopolist's quality choice, we must formalize our description of quality. We treat quality as a continuous variable, denoted s, freely chosen by the company.[9]

---

[9] For a more complete, formal treatment of the possible monopoly effects when quality is variable see Michael A. Spence, "Monopoly, Quality, and Regulation," *Bell Journal of Economics* 6 (1975): 417-429; Eytan Sheshinski, "Price, Quality, and Quality;" and Keith B. Leffler, "Ambiguous Changes in Product Quality," *American Economic Review* 72 (1982): 956-967.

Quality (s) and quantity (q) can enter consumers' demand functions as either "complements" or "substitutes." Quality is said to complement output when increasing quality enhances customers' *marginal* willingness to pay for the product. Alternatively, marginal willingness to pay for output falls when quality is a demand substitute for output. To illustrate, consider a change in the useful life (durability) of some product such as an automobile. Increasing the expected mileage of an automobile before serious breakdown is likely to reduce the consumer's willingness to pay for another automobile in any given year. On the other hand, enhanced features on new car models will tend to complement output and increase the marginal willingness to pay in any given year. Unfortunately, without sophisticated demand estimation, it is not clear which telecommunications services and characteristics are complements or substitutes.

The interrelationship between quality and output can be expressed in terms of the demand curve. Generally speaking, quality adjustment affects both slope and magnitude of the demand curve. The direction of the slope effect in the price-output dimension is determined by whether quality and quantity are substitutes or complements. The slope increases with quality improvements when the two variables are substitutes but declines when the variables are complements. For the case in which each customer only purchases a single unit, quality improvement will result in an upward shift in the willingness to pay for all quantity units. Because many local telephone services are sold to customers on a flat-rate monthly basis, unit demand is a reasonable model assumption. This allows us to focus on quality improvements that raise the demand price on all units sold, thereby making the economic analysis relatively straightforward. Figure 5-1 displays an example of a demand curve shift ($q1$ to $q2$) resulting from an increase in service quality ($s1$ to $s2$). Here we assume that quality and output are demand substitutes and as a result, the new demand curve, $q2$, is steeper.

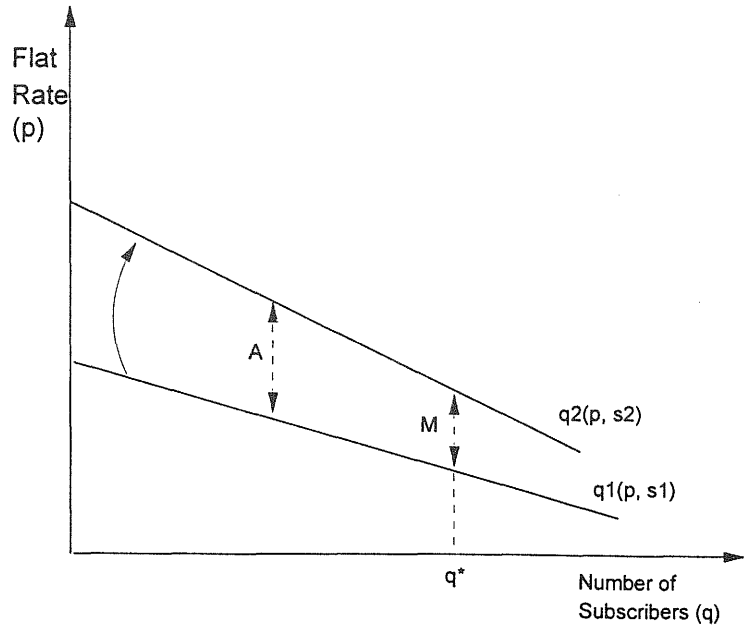

Figure 5-1. Quality change (s1 to s2) when output and quality are demand "substitutes".

Source: Author's construct.

Social welfare decisions should be based on the preferences of the average subscriber. The tendency for the company to focus its profit decisions on the marginal subscriber is the source of monopoly divergence from public interest or economic efficiency goals. At a given number of telephone subscribers, say q^* in figure 5-1, a decision by the monopolist on whether to increase quality from *s1* to *s2* is determined by cost considerations and by how much the marginal subscriber values that improvement. The incremental value to the marginal subscriber is given by the vertical distance between the original and new demand curves, denoted *M* in figure 5-1. Notice that when output and quality are demand substitutes, the marginal subscriber at q^* always values incremental quality improvements less than the inframarginal customers (all those current subscribers that lie to the left of q^* on the horizontal axis). At a given output (q^*), the average subscriber's incremental value (distance *A*) of this quality improvement is greater than that of the marginal

customer. Therefore, at a fixed output, the monopolist always selectes a lower than optimal level of quality when output and quality are demand substitutes.[10]

Alternatively, with the aid of figure 5-2, we can consider a quality improvement for the case in which quality and output are demand complements. Here the new demand curve following the change in quality is flatter than the original. At a given output, the marginal subscriber at q^* values the improvement in quality more than the inframarginal customers and average incremental value. At a given output, then, the monopolist selects a greater than optimal level of quality when output and quality are demand complements.[11]

At a fixed output, the monopolist always selects a lower than optimal level of quality when output and quality are demand substitutes. The monopolist selects a greater than optimal level of quality when output and quality are demand complements.

In the previous stylized examples, we assumed output was predetermined. If we allow the monopolist to select quality, price, *and* output, the clear results given above no longer hold.[12] Even when quality and output are complements, it is likely that the monopolist will undersupply quality in this general case. When we allow output to vary, the relevant average customer for welfare analysis is that representing the complete pool of customers who would be served if the firm just breaks even. With monopoly pricing this includes both actual and potential subscribers. Our previous discussion in which we held output fixed only considered current subscribers and not those potential customers to the right of q^* in figure 5-2. Obviously, those potential customers (for the case of complements) value the incremental improvement in quality more than the marginal subscriber in

---

[10] This result is derived by Spence, "Monopoly, Quality and Regulation," Proposition 1.

[11] Once again this result is derived by Spence, "Monopoly, Quality and Regulation."

[12] For an extensive analysis of the general case, see Sheshinski, "Price, Quality, and Quantity." Sheshinski demonstrates that monopoly equilibrium can involve too much or too little quality regardless of the demand interrelationship between output and quality.

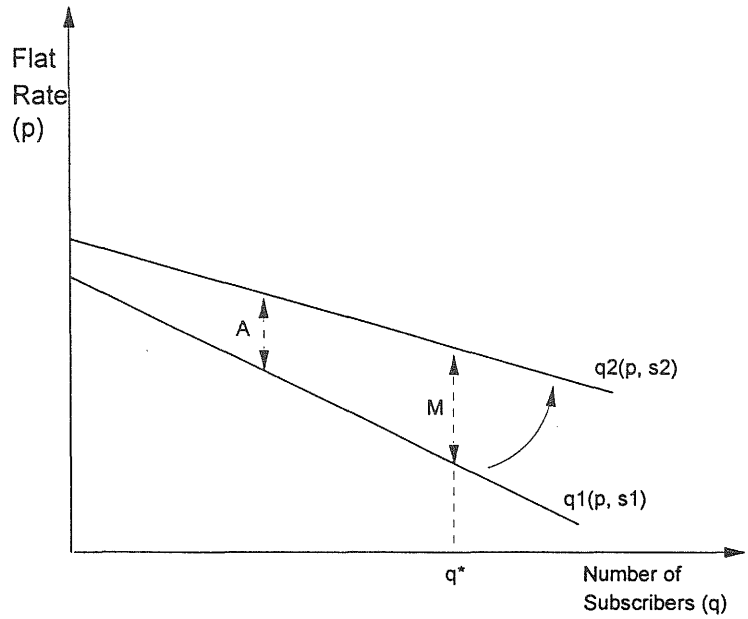

Figure 5-2. Quality change (s1 to s2) when output and quality are demand "complements".

Source: Author's construct.

the unregulated monopolist's profit decision. Thus, when we allow the monopolist to distort output as well as quality, welfare comparisons require that these unserved customers' quality valuations be considered. This implies that the marginal customer's value of the quality improvement may be less than the average incremental value, and the monopolist undersupplies quality even in the case of complements.

MARKET POWER AND THE QUALITY-VARIETY ARRAY

To this point, we have avoided the possibility that the company may offer a "menu" of quality options or a product line. Two examples of quality-differentiated product lines in telecommunications are: (1) enhanced local service options, such as call waiting, caller ID, and ISDN; and (2) premium service/tariff options that

guarantee some level of service reliability.[13] The seminal work of Mussa and Rosen served to establish a theory of monopoly choice of an array of quality options.[14] Besanko, Donnenfeld, and White extend this work to consider not only the effects of monopoly power on the quality array but the impact of various regulatory remedies.[15] The primary conclusion to be drawn from Mussa and Rosen's analysis is that the monopolist will distort the quality array by reducing the quality offered to low-quality-demand (low-end) customers below the socially optimal level in order to discourage high-quality-demand (high-end) customers from purchasing low qualities when the high-end quality option is priced so as to extract the most consumer surplus. This tendency to discriminate on the basis of quality is very similar to certain forms of price discrimination. Dupuit's (1849) description of railroad passenger service provides a good illustration of the market power tendency to quality discriminate:

As long as market power remains unchecked in local exchange markets, the carrier has a profit incentive to reduce basic service quality and introduce optional service enhancements.

> It is not because of the few thousand francs which would have to be spent to put a roof over the third-class carriages or to upholster the third-class seats that some company or other has open carriages with wooden benches... What the company is trying to do is to prevent the passengers who can pay the second-class fare from traveling third-class; it hits the poor, not

---

[13] Service reliability contracts are more common in electric utilities that offer noninterruptible service at premium rates. For a complete NRRI report on reliability differentiation in electricity see Narayan S. Rau and Yousef Hegazy, *Reliability Differentiated Pricing of Electricity Service* (Columbus: NRRI, 1990).

[14] Michael Mussa and Sherwin Rosen, "Monopoly and Product Quality," *Journal of Economic Theory* 18 (1978): 301-317.

[15] David Besanko, Shabtai Donnenfeld, and Lawrence White, "The Multiproduct Firm, Quality Choice, and Regulation," *Journal of Industrial Economics* 36, no. 4 (1988): 411-429; and "Monopoly and Quality Distortion Effects and Remedies," *Quarterly Journal of Economics* (November 1987): 743-767.

> because it wants to hurt them, but to frighten the rich... And it is again for the same reason that the companies, having proved cruel to third-class passengers and mean to second-class ones, become lavish in dealing with first-class passengers. Having refused the poor what is necessary, they give the rich what is superfluous.[16]

This result has important implications for basic telephone service quality as long as market power remains unchecked in local exchange markets, the carrier has a profit incentive to reduce basic service quality and introduce optional service enhancements such as ISDN, broadband access, and service reliability contracts priced at monopoly levels.

Besanko, Donnenfeld, and White provide theoretical results that suggest this effect is promoted when price constraints are relaxed on high-quality services. For instance, they predicted price deregulation in cable television would lead to a distorted service quality array:

> As of January 1987 state and local governments no longer have the authority to regulate the rates cable companies charge subscribers. The theoretical insight provided by our analysis is that this relaxation of price regulation could have deleterious welfare consequences which minimum quality standards may not be able to counteract fully.[17]

Hazlett, however, suggests that deregulation in cable television had just the opposite effect: programming quality and services increased.[18] Hazlett argues that

---

[16] Quoted by Louis Phlips, *The Economics of Price Discrimination* (Cambridge, MA: Cambridge University Press, 1983), 216.

[17] Besanko, Donnenfeld, and White, "Monopoly and Quality Distortion," 744.

[18] Thomas W. Hazlett, "Rate Regulation and the Quality of Cable Television," in *Quality and Reliability of Telecommunications Infrastructure*, ed. William Lehr (Mahwah, NJ: Lawrence Erlbaum Associates, 1995).

price regulation tends to cause the deterioration of basic cable service quality. This result is due to asymmetric price restraints that apply to basic cable service but not to premium service bundles (high-end service). This institutional feature of cable regulation created an incentive for companies to rebundle their service offerings, reducing quality of the regulated basic tier. Although Besanko, Donnenfeld, and White's prediction was theoretically sound, it failed to account for important institutional characteristics of cable regulation: high-end cable services are typically not constrained in price. The main regulatory prescription from the Besanko, Donnenfeld, and White analysis is to place price restraints on *high-end* service to offset the incentive to degrade low-end service. As Hazlett notes, price restraints that only apply to basic service will encourage minimal quality of that service. It remains true, however, that lower basic service quality under price regulation is not just due to ineffective regulatory design but also market power. Without some market power, cable companies could not profitably rebundle services as observed by Hazlett.

If cable service quality was higher during the deregulatory period, as argued by Hazlett, why did Congress reregulate the industry in 1992? Perhaps cable rate increases were not coupled with adequate overall quality increases, encouraging consumer advocates to press for new legislation. Alternatively, Hazlett suggests that reregulation of cable in 1992 was brought on by the lobbying efforts of large broadcasting companies, competitors of cable television.[19]

Related to quality discrimination is the overall availability of service options and quality variety. Since consumer tastes and preferences tend to vary, total social welfare is, in part, determined by the degree to which those various customer types are served (after correcting for any cost savings due to scale economies). A potential competitor observing an incumbent monopolist with large quality differences between the options available to customers (as in Dupuit's rail

---

[19] Cable regulation will be phased out under the Telecommunications Act of 1996.

service example) will see a niche to offer middle-grade service, thereby attracting some of the incumbent's low-end and high-end customers. A monopolist not threatened by such competition will tend to undersupply the number of quality grades. This argument extends beyond quality levels to other service option characteristics.

The following example of a hypothetical automobile monopolist illustrates the incentive to undersupply variety. As the analysis by Mussa and Rosen predicts, an auto monopolist with no competitive threat will attempt to quality discriminate by, for instance, offering only two types of cars: a very low grade model and a luxury model. The monopolist will also tend to undersupply the variety of other characteristics such as colors. The incumbent monopolist may, for instance, find it profitable to supply only white and red cars. Though it may be true that the majority of customers prefer either white or red cars, we can be fairly certain that some considerable portion of auto customers prefer other colors, such as chartreuse or turquoise, over red and white. However, if no substitute suppliers exist, customers must settle for either white, red, or no car under the monopolist's "take it or leave it" strategy. It is likely that a new supplier, if allowed to enter, could profit from satisfying the preferences of customers for unusual colors. More importantly, social welfare unambiguously improves with some profitable entry and the addition of new colors. When entry is prohibited or otherwise not feasible, the monopolist will tend to undersupply service variety. Experience with relaxation of entry restrictions and actual competition in certain telecommunications markets appears to support this claim. For example, compare the variety of telephones and ancillary equipment, such as answering machines, available in the competitive market today to that available from AT&T prior to the FCC's decision allowing subscribers to attach personal equipment to the public network.

THE INFLUENCE OF ECONOMIC REGULATION ON QUALITY

Ratebase, rate-of-return regulation is giving way to competition for a growing number of telecommunications services and to price cap regulation for remaining monopoly services. These policy shifts affect the level and kind of quality consumers can purchase.

QUALITY INCENTIVES UNDER TRADITIONAL REGULATION

In theory, profitable quality improvements by a company subject to rate-of-return regulation generally require an increase in revenue (demand) *and* an additional capital investment. Spence presents a theoretical analysis suggesting potentially positive quality incentives when a firm is subject to rate-of-return regulation: "Rate-of-return constraints force the capital stock up. That will improve quality if quality is capital-using and conversely."[20] This quality result is due to the same forces that generate the capital bias tendency known as the Averch-Johnson effect. Baumol and Klevorick demonstrate that lowering the allowed rate-of-return toward the true cost of capital amplifies the capital bias incentive.[21] The lower the allowed rate-of-return, therefore, the greater the incentive for the regulated company to seek out strategies that increase capital investment while meeting the constraint. If service quality is a capital intensive activity that also increases revenue, the firm is likely to consider quality improvement a more profitable strategy as the rate-of-return constraint becomes more binding. As with capital stock, then, quality levels

---

[20] Spence, "Monopoly, Quality and Regulation," 428.

[21] William Baumol and Al Klevorick, "Input Choices and Rate-of-Return Regulation: An Overview of the Discussion," *Bell Journal of Economics and Management Science* 1 (1970): 162-190.

chosen by a rate-of-return regulated firm are influenced by the allowed rate of return selected by the regulator.

The previous result requires two qualifications. First, as discussed by Spence, any increase in a monopolist's provision of quality when a rate-of-return constraint is invoked is not necessarily socially beneficial. As noted above, quality and output may be either demand complements or substitutes. If the two levels are substitutes, increasing quality is socially desirable, but if quality and output are demand complements, increasing quality is undesirable (see figures 5-1 and 5-2). Second, service quality is not necessarily a capital intensive activity. Certainly some quality dimensions are relatively labor intensive, leading to the opposite result. Customer relations, billing, installation, and repair are obvious dimensions of telephone service that tend to be labor intensive and therefore not necessarily encouraged by a rate-of-return constraint.

Relaxation of Competitive Entry Restrictions

For decades, states explicitly prohibited competitive entry in public utility markets. The economic rationale for entry restrictions stems from the belief that regulated public utilities, including local exchange companies, are natural monopolies and, hence, competitive entry leads to higher total industry costs and lower social welfare. For some time now, analysts have questioned the natural monopoly rationale for local exchange companies. Indeed, a recent study on the period before AT&T's divestiture provides empirical evidence suggesting most local exchange companies are *not* natural monopolies.[22] Given the significant changes in technology since that period, it is likely that the number of local exchanges which continue to be natural monopolies has declined.

---

[22] Richard Shin and John Ying estimate a cost function using data from 58 local exchange companies over the period 1976-1983; "Unnatural Monopolies in Local Telephone," *RAND Journal of Economics* 23 (summer 1992): 171-183.

States have steadily acted to open up telecommunications markets to competition. Every state now allows a restricted form of competition (10XXX dial-around) in the intraLATA long distance markets, and entry barriers will be further relaxed in the future by allowing customers to presubscribe on a "1+" basis to the intraLATA competitor of their choice.[23]

A majority of states now allow full local, facilities based competition as well. Local exchange competition, however, is still in its infancy and primarily limited to the commercial customer market. Residential customer choice of a local service provider continues to be virtually nonexistent in the United States. We can only speculate about the degree to which competition will take hold at the local level. However, we can discuss the expected effects from competition in those areas where it becomes feasible.

Relaxation of regulatory entry barriers, then, is arguably the most effective tool available to the regulator for indirectly influencing quality choice by the industry.

Competitive pressure in the market typically results in lower prices and makes the industry more responsive to customer demand for service quality. Relaxation of regulatory entry barriers, then, is arguably the most effective tool available to the regulator for indirectly influencing quality choice by the industry. Competition increases both the price elasticity and the quality elasticity of the demand faced by the individual firm. For the monopolist, a price increase or a quality decline reduces output demand but only insofar as customers are willing to reduce or cease consumption of the monopolist's service. When customers can substitute among several competing suppliers, the demand facing the individual firm becomes more sensitive to changes in that firm's choice of price and quality.

---

[23] Under the Modified Final Judgment, the Bell operating companies were prohibited from carrying toll traffic across LATA (Local Access and Transport Area) boundaries. Currently, intraLATA toll customers who select a carrier other than their local exchange company must first dial a five digit access code (10XXX). Presubscription in this market would allow the interexchange carriers to compete on an equal basis.

Furthermore, unserved but profitable service quality niches are likely to be filled once a free entry policy is adopted. Just as competitive behavior among companies typically results in lower prices, competition is likely to induce enhanced service quality and greater service variety.

SERVICE CLASSIFICATIONS

Many states have separated local exchange company services into "core" and "noncore," "basic" and "nonbasic," or "competitive," "partially competitive," and "noncompetitive" categories. While these service categorizations differ from state to state, they are typically based on one of two main criteria: the service is available from alternative, competing carriers, or the service is deemed to be "nonessential." Those services determined to be competitive or nonessential are often not subject to rate regulation or are completely deregulated. Here we discuss some potential effects of such a policy on service quality.

Problems can arise from a policy that officially classifies a service as noncore or competitive for the purposes of deregulation (which presumably includes relaxation of quality regulation on those services). For example, authorization of competitive entry and actual market competition are very different. Authorization of competition, even if some entry occurs, does not necessarily imply that the service is provided by a competitive (or contestable) market that is fully responsive to customer demand. All states now authorize competitive entry in the intraLATA toll market. Despite such authorization, the Bell operating companies have clearly maintained a dominant position in these long distance markets.[24] The Washington

---

[24] Larry Blank, David Kaserman, and John Mayo provide empirical evidence that "10XXX competition" has led to lower BOC intraLATA toll prices. However, they also find that the presence of product differentiation when customers are required to dial a five-digit access code to use a competitor's service and excessive charges to competitors for access to the BOC's local facilities have helped the BOCs maintain a dominant status and higher prices. Larry Blank, David Kaserman, and John Mayo, "Dominant Firm Pricing with Competitive Entry and Regulation: The Case of IntraLATA Toll," Working Paper (Knoxville, TN: The University of Tennessee, 1995).

Utilities and Transportation Commission reported in 1989 that typically more than 90 percent of intraLATA toll traffic within a "competitive" LATA is provided by the incumbent Bell operating company (the state of Washington has never banned intraLATA 10XXX competition).[25] Based on the empirical evidence to date, classifying intraLATA toll service as competitive would be clearly inappropriate. Coupling quality deregulation with such a classification could be detrimental to the majority of short-haul toll customers who continue to rely on the incumbent Bell operating company for this service.

Other services that are typically unregulated are the various "noncore" or "nonbasic" service enhancements to local residential service. Many enhanced service offerings were made possible by technological advances such as advanced digital switching and complementary software. Examples include: call waiting, call forwarding, and multi-ring service. Another potential enhancement to basic local service is ISDN. Because most of these services are considered insufficiently "affected with a public interest," the local exchange company is allowed to price many enhancements at profit-maximizing levels. One disadvantage of such a policy, besides the welfare loss due to excessive pricing, is the incentive to maintain low quality for basic tier service, thereby encouraging customers to purchase enhancements. Of course, not all noncore services generate this incentive, but some have the potential to serve a quality-price discrimination strategy such as that described above.

Besanko, Donnenfeld, and White demonstrate that a modest degree of price regulation on high-end services will unambiguously increase social welfare because it limits "the extent to which prices to these high-demand types can be raised and

---

[25] Washington Utilities and Transportation Commission, *The 1989 Report on the Status of the Washington Telecommunications Industry*, submitted to the Washington State Legislature, (Olympia, WA: Washington UTC, Jan. 27, 1989).

therefore reduces the marginal benefit of deteriorating quality [to low-end customers]."[26] Furthermore, their results suggest that such price regulation is more efficient than direct controls on basic service quality. This result may serve as a rationale for price regulation of ISDN or future broadband services, not only to protect high-end customers, but to discourage deterioration of "plain old telephone service." Customers who perform multiple communication tasks at home probably subscribe to multiple access lines and are the most likely to purchase ISDN, which has superior attributes, such as higher transmission capacity (or speed) and the ability to transmit voice and data simultaneously. Broadband technology would likely make ISDN obsolete if not for the price-quality array that is likely to develop. If broadband is made available to residential customers, a menu of three service tiers may develop: standard access line (twisted copper pair), ISDN, and broadband. Although more quality variety would become available to end users, the incentive to discriminate through the price-quality menu remains.

Although price regulation on high-end services protects against quality deterioration of low-end services, overly restraining prices or threatening price regulation of advanced services may discourage investment and innovation in these areas.

Although price regulation on high-end services protects against quality deterioration of low-end services, overly restraining prices or threatening price regulation of advanced services may discourage investment and innovation in these areas. Hence, regulators must be careful to select only modest price restraints on high-end services.

---

[26] Besanko, Donnenfield, and White, "Monopoly and Quality Distortion," 756.

Quality Incentives under Price Caps

Many states have replaced cost-based (rate-of-return) regulation with price cap regulation. As noted earlier in this report, concerns have mounted that a switch to price cap regulation without adequate safeguards could lead to service quality degradation.

Here we investigate some theoretical aspects of this claim. Some policy analysts suggest that without adequate safeguards monopolized telephone service markets will face abnormally high prices to subsidize the competitive operations of the regulated local exchange company.[27] Similarly, the company may have an incentive to divert resources necessary for maintaining adequate quality for monopolized services toward competitive services. For example, local exchange companies often have two customer service telephone numbers: one for residential customers and one for commercial or business customers. Since business services are typically subject to greater competitive pressure, it would not be surprising that relatively greater resources (personnel) are devoted to handling business customer service inquiries.

What happens to incentives for service quality when traditional regulation is replaced by price cap regulation for low-end, monopoly services? The answer to this question relies on several issues. We know that the quality chosen by the company under a price constraint will tend to be socially suboptimal. At the output chosen by the price cap regulated firm, a rate-of-return regulated firm would select higher "capital intensive" quality. However, even when quality is capital intensive (which may be a strong assumption), we still do not know the equilibrium output levels produced under each regime because these are, in part, determined by the control levels imposed by the regulator (price and rate of return). Hence, equilibria

---

[27] Such cross-subsidization is a form of predatory pricing and served as an important premise in the Department of Justice's case against AT&T which ultimately led to AT&T's divestiture from its monopolized local operations.

and quality choices under the two regimes are not comparable without more information on constraint levels or equilibrium outputs.[28]

Why does the firm regulated by price caps choose suboptimal quality levels when the price constraint is binding? As with most profit-related questions, the answer to this question depends on both cost- and demand-side considerations. On the cost side, the price-constrained firm is seen to be the residual claimant to any cost reductions including those resulting from quality degradation. On the demand side, the firm under price cap regulation is not fully rewarded for quality improvements that increase consumers' willingness to pay because price cannot move upward with subsequent shifts in demand. Together these characteristics of price cap regulation imply lower rewards for quality improvements, causing the firm to undersupply quality.[29]

Brennan confirms the previous finding:

> If the price caps are not tied to quality in some way, and if quality can be varied by the firm, it may have an incentive to reduce quality inefficiently in the face of a price control.[30]

---

[28] Shane Greenstein, Susan McMaster, and Pablo Spiller provide empirical evidence that price cap regulation creates new incentives to invest in modern technology for which quality may be a by-product. Theoretically, systematic investment differences between rate-of-return regulation and price cap regulation cannot be derived; Shane Greenstein, Susan McMaster, and Pablo Spiller, "The Effect of Incentive Regulation on Infrastructure Modernization: Local Exchange Companies' Development of Digital Technology," *Journal of Economics and Management Strategy* 4 (summer 1995): 188-236. Larry Blank, Vivian Witkind Davis, and Catherine Reed provide alternative empirical findings supporting this theoretical ambiguity; *Telecommunication Infrastructure Investments and State Regulatory Reform: A Preliminary Look at the Data* (Columbus: NRRI, 1994). See also Michael Clements, "Regulatory Reform and Modern Infrastructure Deployment in the Telecommunications Industry," *NRRI Quarterly Bulletin* 16, no. 4 (1995): 549-567.

[29] For a formal proof of this tendency, see Spence, "Monopoly, Quality and Regulation," footnote 7, 7.

[30] Timothy J. Brennan, "Regulating by Capping Prices," *Journal of Regulatory Economics* 1 (1989): 133-147.

Therefore, the negative quality incentives of price cap regulation would be attenuated if we could design regulation in which price adjustments were allowed for quality improvement. Such an incentive structure characterizes recent regulatory proposals discussed below.

Several previous authors dispute the purported differences between rate-of-return regulation and price cap regulation, claiming that, in practice, regulators find it difficult to sever all links to cost-based analyses.[31] Rate-of-return regulation is characterized by extended periods between rate cases (regulatory lag), making it appear as though prices, not the rate of return, are actually constrained in traditional regulatory regimes.[32] Alternatively, recent observers of price cap regulation note the lack of complete departure from cost-based analyses or even the use of rate-of-return targets within the price cap framework.[33] These practical observations lead us to conclude that the incentive to overinvest in capital and the provision of capital intensive quality may not be as great as that suggested by the Averch-Johnson effect and Spence. Similarly, the theoretical quality incentives of price cap regulation may be understated.

The negative quality incentives of price cap regulation would be attenuated if we could design regulation in which price adjustments were allowed for quality improvement.

---

[31] For an overview and theoretical explanation see Larry Blank, "Choosing Inefficiency: Why Regulators Combine Price and Rate-of-Return Restraints," Working Paper (Columbus: The Ohio State University, 1995).

[32] The analytical importance of this observation was emphasized in a series of papers by Paul Joskow, "The Determination of the Allowed Rate of Return in a Formal Regulatory Hearing," *Bell Journal of Economics and Management Science* 3 (1972): 632-44; "Pricing Decisions of Regulated Firms: A Behavioral Approach," *Bell Journal of Economics and Management Science* 4 (1993): 118-140; and "Inflation and Environmental Concern: Structural Change in the Process of Public Utility Price Regulation," *Journal of Law and Economics* 17 (1974): 291-327.

[33] See Ronald R. Braeutigam and John C. Panzar, "Effects of the Change from Rate-of-Return Regulation to Price-Cap Regulation," *American Economic Review* 83, no. 2 (May 1993): 191-198; Kwoka, "Implementing Price Caps;" and Leland L. Johnson, *Toward Competition and Cable Television* (Cambridge, MA: MIT Press, 1994).

DEVELOPMENT OF REGULATION WITH BUILT-IN QUALITY INCENTIVES

The negative quality incentives associated with price cap regulation increase the importance of social, or protective regulation and the development of modified or alternative schemes that improve profit incentives with respect to quality provision.

Direct telephone quality regulation, as described at length in chapter 3, has traditionally employed a system of measured attributes and standards as well as a method for monitoring individual customer complaints. Usually this system is coupled with some method to ensure company compliance. This is an important tool used by state regulators to ensure adequate quality levels. Our survey results showed that many states have modified their standards or compliance methods during the past decade (see chapter 3). This increased activity on the part of state regulators is often in part due to the adoption of alternative forms of economic regulation that gives companies greater flexibility to improve production and pricing efficiency but has the unintended effect of creating an incentive for companies to cut costs used to maintain high quality levels.

The increasing reliance on protective regulation to ensure quality should be evaluated on economic grounds. We argue that the system potentially falls short because of informational problems that prohibit regulators from establishing perfect controls.

The increasing reliance on protective regulation to ensure quality should be evaluated on economic grounds. We argue that the system potentially falls short because of informational problems that prohibit regulators from establishing perfect controls. This does not imply that direct quality regulation methods should be abandoned. For reasons of feasibility and the nature of the regulatory process, many commissions may find that their existing approaches to quality assurance are what work best in their states. But it does suggest that commissions may wish to consider modifying or complementing existing controls with alternative incentive

schemes. Imperfect information is a condition regulators are often confronted with, forcing them to consider control methods that are "second best" in the abstract.

Limits of Current Protective Quality Regulation

Inadequate regulator information can lead to imperfections in existing methods of quality regulation. First, not all relevant service characteristics are easily observable, measurable, and verifiable.[34] Second, even when service characteristics are measurable, the costs of supplying quality and consumer valuation of quality are typically unknown or imperfectly known to the regulator or even the company. These information problems make it difficult for regulators to identify and measure the service attributes valued by telephone customers and determine the socially appropriate levels for these attributes.

Direct quality regulation does not adequately reward or punish the firm for improving or degrading quality dimensions that are unobservable, unknown, or simply overlooked by the regulator. Enforcing quality standards based on measurable service attributes when there exists some set of unobservable or unmeasurable attributes potentially introduces a regulatory bias. Direct quality regulation places an artificial premium on monitored attributes and reduces the relative net value (to the firm) of those attributes still demanded by customers but unmonitored by regulators. Just as a rate-of-return constraint leads to a capital input bias, regulation of the measurable subset of all relevant service attributes encourages inefficient reallocation of resources away from other service attributes toward those attributes identified by regulators, which may or may not be valued

---

[34] Some service attributes may be *observable* by the contracting parties (for example, the firm and the regulator) but not *verifiable* to a third party, such as a court of law, as often required for binding contracts. See the discussion in Jean-Jacques Laffont and Jean Tirole, *A Theory of Incentives in Procurement and Regulation* (Cambridge, MA: MIT Press, 1993), Chapter 4.

by customers.[35] An additional information problem is created by cost and demand uncertainties. Information on the cost of supplying quality and quality demand is necessary to determine the appropriate standards for the observable subset of service characteristics.

The economic imperfections of direct controls or standards on service quality suggest that it would be valuable to search for modifications in the use of measured service attributes or indirect incentive methods that can be used by regulators to complement standards and encourage high service quality over all relevant service attributes. We will summarize two modifications to direct quality regulation that intend to improve quality measurement and quality incentives and work to mitigate both company and regulatory inefficiencies.

A single, overall quality index is an improvement over conventional standard setting and direct quality regulation.

The Berg-Buzas-Lynch Proposal: A Single Quality Index Computed from Multiple Attributes

In 1986, a research team comprised of Sanford Berg, Thomas Buzas, and John Lynch, from the University of Florida's Public Utility Research Center (PURC) began developing a telephone quality measurement scheme for the Florida Public Service Commission.[36] The group proposed that a single, overall quality index be

---

[35] The use of automatic fuel adjustment clauses by electric utility regulators in the past was a source of similar allocative distortions. See David L. Kaserman and Richard C. Tepel, "The Impact of the Automatic Adjustment Clause on Fuel Purchase and Utilization Practices in the U.S. Electric Utility Industry," *Southern Economic Journal* (1982): 687-700; and Robert E. Burns, Mark Eifert, and Peter A. Nagler, *Current PGA and FAC Practices: Implications for Ratemaking in Competitive Markets* (Columbus: NRRI, 1991).

[36] For an overview and history see Sanford V. Berg, "A New Index of Telephone Service Quality: Academic and Regulatory Review," in *Quality and Reliability of Telecommunications Infrastructure*, ed. William Lehr (Mahwah, NJ: Lawrence Erlbaum Associates, 1995). Theoretical and empirical research by the group can be found in Berg and Lynch, "The Measurement and Encouragement of Telephone Service Quality;" and Lynch, Buzas, and Berg, "Regulatory Measurement and Evaluation of Telephone Service Quality."

calculated from the service characteristics data collected by Commission staff. The scheme provides an improvement to conventional standard setting and direct quality regulation. The overall measure of service quality gives the firm greater flexibility to determine the most efficient method to comply with some minimum overall quality level. Three primary attributes of the PURC quality index are:

1. The weighted index provides a single measure of overall telephone service quality, easing commission decisions once the index is developed, as well as design of an overall incentive plan for telephone companies.

2. Most states already systematically monitor several service quality dimensions needed for calculating the weighted quality index. (Florida monitors 38 such dimensions, many more than most states.)

3. Unlike mandatory standards on each individual quality component, the single quality index allows for more novel regulatory schemes which give the company far greater flexibility to select more efficient ways to meet some overall level of service quality.

Berg, Buzas, and Lynch recommend two possible applications for the weighted quality index. First, the weighted index provides a consistent single measure that could be used for relative quality comparisons across telephone companies in the state. Differences among quality indices across companies could serve as the foundation for an incentive system or "yardstick competition" based on relative company performance. Second, the authors suggest that rewards and punishments could also be based on trends in the absolute level of the company's weighted quality index. Incentives under either method are implemented by adjusting the allowed rate of return or price caps. These possible linkages to company incentives are similar to those suggested by Noam, discussed below.[37]

The weighted quality index scheme has two limitations. These have been emphasized above and are primarily due to the informational problems associated

---

[37] Eli M. Noam, "The Quality of Regulation," 179-186.

with identifying and measuring individual service attributes, not so much to the design of the weighted quality index. First, the measurement requires that weights be assigned to each service attribute identified by the regulator. Lack of information on costs and customer preferences, which is necessary for establishing appropriate weights on each attribute, may lead to inefficiencies. Lynch, Buzas, and Berg suggest a method to minimize this limitation that uses expert regulators' opinions.[38] Second, the approach does not necessarily encompass all service attributes valued by customers but simply overlooked or unmeasurable by regulators. These excluded quality dimensions provide another potential source for inefficiency. Therefore, the measurement proposal remains susceptible to some of the same informational problems and economic biases characterizing the traditional forms of direct quality regulation.

Modifying Price Cap Regulation with a Service Quality Factor

Kihlstrom and Levhari demonstrate "that if the price a seller can obtain is independent of quality he will have no incentive to produce goods of anything but minimal quality." Based on this theoretical conclusion, they make the following policy recommendation: "Thus any regulation scheme which is intended to induce optimal quality as well as quantity decisions must involve prices which are sensitive to quality variations."[39] Noam proposes a regulatory scheme aimed at conforming with the Kihlstrom and Levhari principle for proper quality incentives. Noam suggests that a service quality factor be added to the conventional price cap formula.

---

[38] Lynch, Buzas, and Berg. "Regulatory Measurement and Evaluation of Telephone Service Quality."

[39] Kihlstrom and Levhari, "Quality, Regulation and Efficiency," 225.

Noam's proposal is briefly summarized in the following steps to be taken by the regulator:[40]

Step 1. Select the "relevant" quality dimensions

Step 2. Set quality standards

Step 3. Assign weights to quality dimensions and calculate an overall weighted average or index for quality[41]

Step 4. Monitor quality

Step 5. Link quality performance to company profit incentives

The final and most important step of Noam's proposal is the incentive component of the scheme. Noam recommends making this linkage through prices:

> [W]here quality is substandard, user prices are cut; where quality is above standard, they may be raised. This is equitable to ratepayers: poor service will cost them less than good service, because it is not the same thing. And it is fair to the company, which gets carrots for quality improvements, and sticks for deterioration.[42]

The quality component calculated in Step 3 can be included in the annual price cap adjustment formula as follows:

$$\Delta P = I - X + N(S^* - T),$$

where ΔP is the automatic, annual price change, I is an inflation measure, X is the productivity offset, N is the positive quality incentive factor, S^* is measured quality

---

[40] See Noam, "The Quality of Regulation" for detailed elaboration on each of these steps.

[41] This step is similar to the weighted index proposed by Berg, Buzas, and Lynch and discussed above.

[42] Noam, "The Quality of Regulation," 184.

performance, and T is the target quality (standard). If S^* fails to attain the standard level, T, the company is punished by a lower price; if S^* exceeds T, the company is rewarded by a factor N. Clearly, the quality factor has the potential to encourage greater performance on those quality characteristics measured by the regulator than does price cap regulation without a quality of service adjustor.

The quality incentives of price cap regulation are improved by Noam's modification and provide a considerable improvement over traditional command-and-control methods. However, the modified price cap scheme remains susceptible to some of the same informational problems as traditional regulation. In addition, lack of adequate regulator information implies that the quality factor method runs the risk of either over- or under-encouraging service quality relative to that value placed on quality by the consumer.

A modified price cap scheme was formally considered in 1994 by the Public Utilities Commission of Ohio, which ultimately chose to adopt a truncated version.[43] The version adopted by Ohio only includes disincentives (lower prices) when quality measures fail to meet the Commission's standards. Positive incentives (higher prices) for greater than standard quality, as recommended by Noam, were rejected. A report commissioned by the Public Utilities Commission of Ohio raised the possibility that a service quality factor may over-reward the company for quality improvements.[44] We can analyze this potential negative aspect with the aid of figure 5-3.

The quality factor chosen by the regulator in a modified price cap plan runs the risk of either over- or under-rewarding the firm for quality provision because the price adjustment is not linked to actual changes in demand or the additional customer willingness to pay for the quality improvement.

---

[43] A similar truncated version was recently adopted in Massachusetts.

[44] Vivian Witkind Davis, Raymond W. Lawton, and Edwin A. Rosenberg, *An Analysis of Selected Aspects of Ohio Bell Telephone's Application for Alternative Regulation: Price Caps, Service Classifications and Infrastructure Commitments* (Columbus: NRRI, 1994).

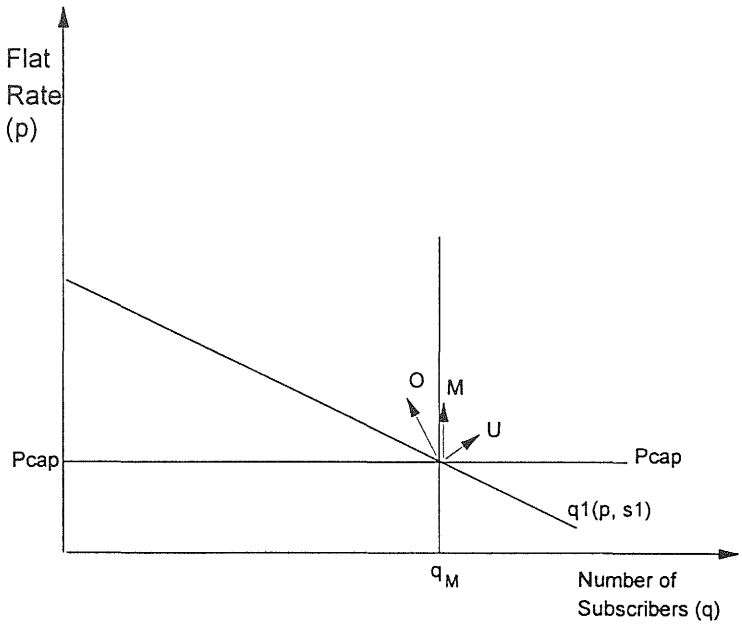

Figure 5-3. Possible price cap adjustments with a service quality factor.

Source: Author's construct.

The quality factor chosen by the regulator runs the risk of either over- or under-rewarding the firm for quality provision because the price adjustment is not linked to actual changes in demand or the additional customer willingness to pay for the quality improvement. In figure 5-3, the price-quality path given by the arrow labeled *O* corresponds to a service quality factor that allows the firm to raise its price more than the additional customer value of the quality improvement. The path labeled *U* underrewards the firm relative to the marginal customer valuation of the quality change. Because quality improvements are costly, a service factor represented by path *U* stifles quality provision, inducing the firm to select a quality level less than that which existing customers are willing to pay for. The middle path, denoted *M*, rewards the firm for quality improvements with price increases that just equal the incremental change in customer demand price. Only path *M* ensures that quality decisions made by the company are in line with the preferences

of current customers. Because the quality factor chosen by the regulator is not necessarily based on actual customer preferences, however, path *M* is not likely.

Conclusion

This chapter has summarized telecommunications service quality incentives in competitive and monopoly environments and possible quality effects of alternative regulatory policies. The decision to remove competitive entry restrictions can positively influence service quality, but we have highlighted some potential limitations even in a free market environment. State decisions to separate telephone services into categories such as "core" and "noncore" can affect overall service quality in various ways. Most notable is the incentive to discriminate using a hierarchical quality-price menu of service options. The adverse implications of such behavior can be mitigated through moderate price regulation of high-quality services.

Whereas traditional rate-of-return regulation can encourage companies to provide relatively high levels of certain quality characteristics, price restraints give firms an incentive to seek suboptimal quality for monopolized services. With the general shift towards price regulation throughout the United States, it is worth taking a look at ways commissions may improve their protective regulatory efforts.

We have evaluated (on economic grounds) direct quality regulation, as well as two schemes that improve the traditional standard-making model. Berg, Buzas, and Lynch provide an improvement to traditional quality standards by proposing a single weighted index to measure overall telephone service quality. The scheme gives the regulated company and regulators considerable flexibility to efficiently select monitored service attribute levels and experiment with linking quality performance to firm profit incentives. Despite its advantages, however, the weighted quality index requires considerable regulator information, potentially causing service attributes to be weighted improperly or to be completely overlooked

by regulators, thereby resulting in economic inefficiencies. We discussed Noam's plan to improve quality incentives by including a quality factor in the conventional price cap formula.[45] Although this incentive scheme conforms to established economic principles, these advantages are partially offset by the possibility that price caps could be adjusted too much or not enough relative to actual customer value of quality.

Quality standards and incentive systems in a regulatory environment necessarily result in a "second-best" solution. Absent robust competition, regulatory policy makers need to continue to be aware of the imperfections of any method of overseeing quality.

---

[45] Noam, "The Quality of Regulation."

CHAPTER 6

DESIGNING QUALITY OF SERVICE POLICIES FOR THE NETWORK OF NETWORKS

Early in this report, we presented a framework for considering new problems in service quality based on a linchpin model of the network of networks, where a local exchange carrier is still the dominant player in the market for telecommunications services and provides the technical platform to which all other providers must hook up (see Figure 2-1). We identified several general types of controls on service quality in that initial conceptual framework and have now explored in some depth the implications of market controls, industry standards, economic regulation and protective regulation.

The linchpin network, where the local exchange carrier is the "center of all regulatory efforts," may only be transitional. Eventually, it may be replaced by the intermeshed network.

To structure discussion of policy directions for the future, it may be helpful to consider an alternative concept, the intermeshed network. Bernt suggests that the linchpin network, where the local exchange carrier is the "center of all regulatory efforts," may only be transitional.[1] Eventually, it may be replaced by a configuration that includes several types of participants with similar physical, financial and strategic assets. In figure 6-1 these players are identified as cable, local exchange, personal communications services, competitive access, cellular, and private networks. In fact, we do not yet know what the appropriate names are.

---

[1] Phyllis Bernt, *Regulatory Implications*, 32.

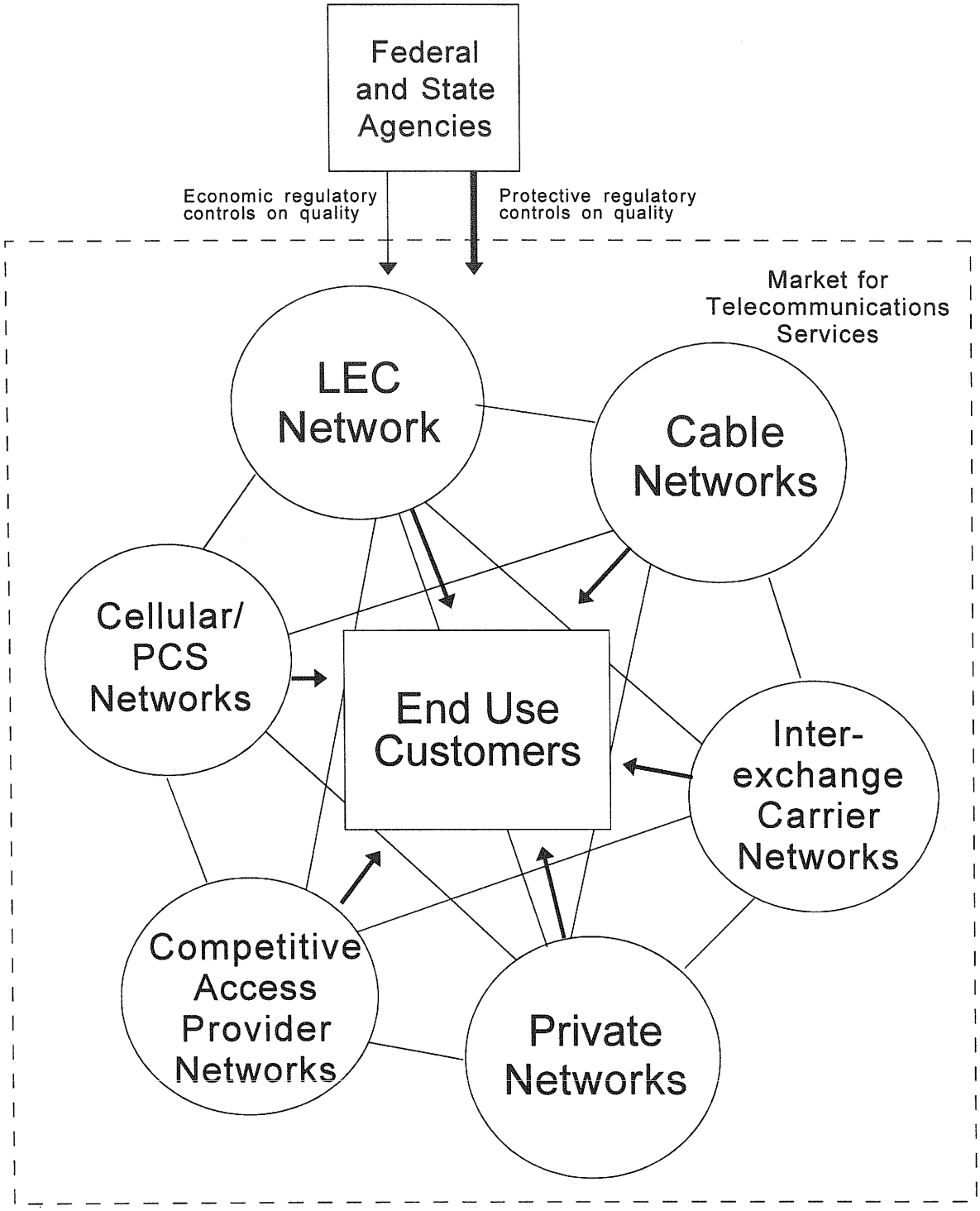

Fig. 6-1. Quality of Service in The Intermeshed Network.

Source: Author's construct, based on Bernt, *Regulatory Implication of Alternative Network Models.*

Mergers and breakups can easily alter that landscape. What the figure does convey is that, whatever the names of the players, they would be rivals and customers in the market for telecommunications services. There will be many providers of many services. Providers will be both buyers and sellers of services to each other and sellers to end users. Figure 6-1 shows each type of provider offering service/quality to end-use customers. Each type of provider could also offer service/quality to all others.

Yet even in a competitive market, there would remain positive externalities from interconnection and the weaknesses that any market may be subject to, most notably in providing information to consumers. Government oversight of interconnection and of quality of service might still be called for if the intermeshed network is indeed what develops. Figure 6-1 shows federal and state agencies (possibly local ones as well) playing such a role. Since the intermeshed model of the network of networks assumes monopoly power would be greatly diminished if not eliminated, government oversight would primarily be felt through protective regulation rather than economic regulation. The intermeshed model shows the interests of the end-use customer as central, with little attention to the internal systems of any particular carrier.

The job facing regulators attempting to design quality of service policies may be derived directly from consideration of figures 2-1 and 6-1 and the differences between them. Figure 6-2 lays out changes over time in the public switched network, the market for telecommunications services, and economic and protective regulation. Before the AT&T divestiture the network was unified, market structure was monopolistic, and economic regulation was ratebase/rate-of-return with protective regulation in support. Today we are in a transitional period, moving from a time when the network offers parallel services, like cable and telephone, to the linchpin network discussed in chapter 2. In the linchpin model, other networks are connected to the local exchange carrier, and provide similar services, but are not necessarily connected to each other. The linchpin model shows the beginnings of

	Past	Transition		Future
Network	Unified	Parallel Services	Linchpin	Intermeshed
Market Structure	Monopoly	Duopoly or Oligopoly for some services	Oligopoly for many services	Competitive
Economic Regulation*	Ratebase/ rate-of-return	"Alternative" Regulation	Price Regulation	Demand
Protective Regulation	Traditional quality of service regulation	- Strengthened protective regulation - Minimum subscribership regulation - Informing and educating consumers - Proactive role in industry standard setting		Customer-centered quality of service regulation

Fig. 6-2. Approaches to quality of service in the transition to an intermeshed network.

* This trendline is descriptive rather than prescriptive of observed changes in economic regulation. The reader should not infer that there ought to be price regulation when there is oligopoly.

competition, through duopolies and oligopolies, and the intermeshed model its flowering.

Since, as discussed in chapter 5, competition can effectively discipline quality, the process underway now at the federal and state levels of laying the groundwork for competitive markets supports the goal of maintaining and enhancing service quality. The linchpin model shows continuing monopoly power, and policy makers must attend to the issues of a transition of uncertain duration. This necessitates improving controls over monopoly provision of quality of service, particularly, strengthening the connection between price regulation and quality.

Earlier, we presented a typology of emerging issues in telecommunications quality of service based on six separate aspects of quality and whether they were born from the exigencies of new technology, market structure or network needs (Table 2-4). It is beyond the scope of this report to offer solutions for every problem we raised for the criteria of availability, reliability, security, flexibility/choice, simplicity and assurance. What we can do is to propose for consideration by commissioners and staff a number of policy changes that might be undertaken during this time of transition. The technological issues identified in chapter 2 are (and should be) outside of commission influence. Market issues, including both those raised by continued monopoly provision of basic telephone service and the beginnings of competition, are of considerable concern to regulators, as are interconnection issues. In this chapter we will suggest broad approaches to strengthening protective regulation for telecommunications services that continue to be provided by a monopolist, services that are supplied under either monopoly or competition, and services provided through the interconnection of multiple providers. The proposals are presented not as hard and fast recommendations but as ideas for commissions to consider in negotiating the shift over time to a network of networks, probably first towards the linchpin model and eventually towards an intermeshed one.

The first and easiest steps for commissions to take would be to strengthen traditional regulatory programs, often along the lines already being taken across the country (see chapter 3). Improvements in the standards themselves and in policies and programs may be proposed. Regional and national cooperation, better monitoring and enforcement and reallocation of scarce commission resources might help many commissions to tackle new challenges in service quality.

We discussed earlier the weaknesses of both traditional economic regulation and modified price regulation for ensuring quality (see chapter 5). The ultimate extension of a shift from focusing on quality rather than price for customers who

are still captives of a monopoly provider of basic service would be a new incentive system that in essence stood the relationship of economic and social regulation on its head. A "minimum subscribership plan" would make rewards to the utility for its continuing market domination contingent on fulfilling responsibilities in one of the most important areas of service quality (broadly speaking)–availability.

Traditional regulation as currently practiced focuses more on companies than on end users. As the intermeshed network and competition evolve, policy makers should be developing new ways of emphasizing the centrality of customer wants and needs. "Customer-centered regulation" is an outgrowth of current efforts to enhance protective regulation. Even when the market for telecommunications service is competitive, customers will need information to exercise choice and be assured of the level of quality they want. For both monopoly and competitive services, consumer education and perhaps a quality labeling program should be considered.

Chapter 4 reviewed forces at work that might call for greater government expertise and involvement (or at least influence) in industry standard setting. The process of identifying and agreeing on industry standards is complex and political. The controversial nature of setting standards is likely to increase as more players enter the fray with more to win or lose. It behooves commissioners and staff to take a close look at experience and models in the industry processes of standard setting to gain insight into the need for possible forms of public involvement in addressing interconnection issues. We will analyze avenues for such involvement. We first discuss means of strengthening protective regulation, including cooperative efforts, better monitoring and enforcement, improved resource allocation and changes in the standards themselves.

Strengthening Traditional Protective Regulation

Most telecommunications customers in the United States are likely to continue to receive basic service from a single monopoly provider for a long time. Estimates vary as to how long it will be before markets in most areas have several ubiquitous, facilities-based or full-service telecommunications providers. It seems reasonable to assume that this will take at least a decade. Accordingly, a commission should develop oversight strategies that facilitate an eventual transition, but also assure continued service quality.

Regional and National Cooperation

One route to strengthening protective regulation is cooperative effort, either within a region, or nationally, through NARUC.[2] Cooperation and coordination within NARUC, exemplified in the panel presentations at the 1996 winter committee meetings in Washington, D.C., should aid in strengthening protective regulation. Five panels on telecommunications service quality were jointly planned by the Consumer Affairs, Telephone Quality of Service, Engineers and Communications Staff Subcommittees and the Communications and Finance and Technology Committees. Coordination of state activity and the FCC is also called for.

Faced with the declining service discussed at the beginning of this report, the 14 commissions in states served by U S West in 1995 used their Regional Oversight Committee (ROC) to develop suggested service quality standards. The ROC considered standards and service levels across the nation and worked closely

---

[2] For background on regional regulation, see Edwin A. Rosenberg et al., *Regional Telephone Holding Companies: Structures, Affiliate Transactions, and Regulatory Options* (Columbus: NRRI, 1993); and Douglas N. Jones, et al., *Regional Regulation of Public Utilities: Opportunities and Obstacles* (Columbus: NRRI, 1992).

with the company to develop a consensus on provisioning, repair, access to the company's repair services and business offices, repeat occurrences of problems, outages and reporting. Reviewing the results of their efforts, the Committee said, "The ROC standards provide customers a level of service consistent with technical capabilities in the telephone industry and are achievable in light of past U S West and current industry performance."[3] The standards, however, were not wholly agreed to by the company.

While regional regulatory efforts hold promise, the process is difficult and time-consuming, and there is potential for standards to be driven down to a lowest common denominator.

Commissioner Bob Rowe of the Montana Public Service Commission suggests that sharing information within the region helps combat incomplete and narrow information provided by the regulated company, including company representations that a problem has already been worked out a certain way in other jurisdictions. He recommends that states coordinate their strategies and pool their resources to solve service quality problems that are similar across state boundaries.[4] While regional regulatory efforts hold promise, the process is difficult and time-consuming, and there is potential for standards to be driven down to a lowest common denominator.

---

[3] U S West Regional Oversight Committee, *Service Quality Standards*, Oct. 1, 1995, unpublished Xerox, 1.

[4] Commissioner Bob Rowe, Montana Public Service Commission, telephone conversation, Dec. 22, 1995.

ENFORCEMENT

Tightened oversight of service quality cannot be effective without adequate monitoring and enforcement that bites. Realizing that service quality is at risk as companies move towards price cap regulation, commissions have been stepping up efforts to guarantee continued good service. Recent decisions continue to apply penalties under price cap regimes when service quality is inadequate. In Idaho, a proposed new price regulation plan would allow U S West to increase residential rates three times during the five years the plan is effective, but only if the company meets service quality goals in ten specific areas of provisioning, repair and access to the company. Points would be achieved by the company for meeting service levels and the points added to form a monthly service quality score.[5]

In the Ameritech region, the Public Utilities Commission of Ohio and Ameritech-Ohio reached agreement in 1995 to customer credits and possible civil forfeitures. The credits totaled $270,000 to customers who had experienced disruptions in service that lasted 72 hours or longer or whose listings were omitted from the "white pages." Forfeits could total $690,000 before Aug. 31, 1996, if the Commission's minimum telephone service standards are not met.[6] The company said it was planning to hire 375 employees to improve its customer service.[7] A survey by the Michigan Public Service Commission reported that in November 1995, eight commissions in areas other than U S West's were

---

[5] "N.C., Idaho Consider New Telco Price Regulation Schemes," *State Telephone Regulation Report* 13, no. 22 (Nov. 2, 1995): 2.

[6] "Ameritech-Ohio Settles Service Complaint Probe," *State Telephone Regulation Report* 13, no. 20 (Oct. 5, 1995): 13-14.

[7] Alan Johnson, "PUCO Orders Probe of Ameritech," *Columbus Dispatch*, 11 Aug., 1995.

considering investigating or were in the process of investigating telecommunications service quality.[8]

Enforcement measures are already difficult for commissions to impose and may become increasingly so as competition emerges. During the transition, commissions may no longer have the ability to offer meaningful financial relief to jurisdictional utilities for provision of monopoly services, even when justified.

The form of regulation may not be a critical determinant of service quality.

Remedial actions may also be constrained because many commissions have limited ability to fine a utility for service quality deficiencies. Even for those commissions that can levy fines, often the penalties are so low that they represent no significant financial sacrifice in and of themselves. Many state regulatory pricing reforms include quasi-enforceable statements that the utility's eligibility for participation in the alternative regulatory plan is dependent upon the quality of service provided. The impact of sanctions envisioned under price regulation is yet to be demonstrated. The New York Public Service Commission, for example, has just gone through a long, difficult process to impose credible sanctions and encourage Nynex to improve service, particularly in the greater New York metropolitan area. A new incentive plan, effective for 1995 to 2001, is dependent on meeting service criteria.[9] Nor is it clear that the form of regulation is a critical determinant of service quality. As pointed out by Eileen Benner of the Idaho Public Utilities Commission, the states in the U S West service area have many different forms of regulation, from price caps to traditional ratebase, rate-of-return regulation.[10]

---

[8] Michigan Public Service Commission, *Quality of Service Investigations Survey,* November 1995, unpublished Xerox.

[9] New York Public Service Commission. Opinion No. 95-13. Issued Aug. 16, 1995, *Adoption of Performance Based Regulation Plan for New York Telephone*, Case No. 992-C-0665 (Albany, NY: New York PSC, Aug. 16, 1995).

[10] Eileen Benner, Idaho Public Utilities Commission, letter, Jan. 10, 1996.

Some empirical work on the relationship of price caps and service quality has been done but the results are mixed and inconclusive. Tardiff and Taylor found that quality of service did not suffer under incentive regulation, including price caps. The authors found that states with explicit quality standards showed greater improvement in service quality under alternative regulation than those without, although the states with standards had somewhat lower service quality to begin with than the ones without explicit quality of service standards.[11] Norsworthy and MacDonald, however, found that large local exchange carriers showed evidence of trading off service quality against efficiency and profitability. They did not distinguish among types of regulation in their study.[12]

In the absence of rate cases, commissions must make every effort to continue to exercise their authority where captive ratepayers are shortchanged. Commissioner Rowe suggests that penalties should be automatic to reduce the potential for gaming the process.[13] Barbara Alexander, Chair of the NARUC Staff Subcommittee on Consumer Affairs and Director of the Consumer Assistance Division of the Maine Public Utilities Commission, suggests that penalties may be more effective if targeted to individual customers (like Colorado's free cellular service to compensate for late installation of wireline service, mentioned in chapter 1) rather than given back to all ratepayers as a minor bill credit or rebate.[14]

---

[11] Timothy J. Tardiff and William E. Taylor, "Telephone Company Performance Under Alternative Forms of Regulation in the U.S." (Cambridge, MA: National Economic Research Associates, Sept. 7, 1993), unpublished paper.

[12] John R. Norsworthy and James C. MacDonald, "Service Quality at Large Local Exchange Carriers: Is There a Tradeoff Between Efficiency and Quality?," in *Proceedings of the Ninth NARUC Biennial Regulatory Information Conference* (Columbus: NRRI, 1994), 393-421.

[13] Commissioner Rowe, telephone conversation, Dec. 22, 1995.

[14] Barbara Alexander, e-mail communication, Jan. 24, 1996.

MONITORING

COMPANY REPORTS

The ability to follow through with enforcement measures of course depends on the effort put into monitoring. Company reports with audit-quality data may well become rarer as traditional regulatory controls are loosened. To assure service quality, commissions will need to carefully review the sorts of data that will be needed. They should make sure that the companies report statistics regularly at an appropriate level of detail (both statewide and wire center) in an agreed upon format. Audits of service quality as part of company-wide management audits or as free-standing, focused audits, might be initiated.[15]

Another area for improvement in company reporting is in the area of outages. More specific outage data can and should be provided. Historically companies have reported outages in terms of number of lines. Using traffic data, it is possible to estimate the actual magnitude of an outage in terms of lost calls. This could be incorporated into commission standards and weighting schemes.

FIELD INVESTIGATIONS

Field investigations are a relatively costly form of monitoring. Alan Taylor of the Florida Commission claims that they continue to be "the single most viable way to measure service quality."[16] He suggests that field investigations are probably needed for commissions to make informed decisions about the service quality of new entrants. Guy McDonald, telecommunications analyst at the Kansas Corporation Commission disagrees:

---

[15] Ibid.

[16] Alan Taylor, e-mail communication, Jan. 5, 1996.

> Field investigations may have had a place and a cost effective role with the more traditional electromechanical analog services. However, in today's public switched network, which relies heavily upon remote operational support systems, common channel signaling, SONET capable fiber optic facilities, and host-remote switching systems, it would be extremely difficult, costly, and, in my opinion, inappropriate to develop (and maintain) the expertise necessary to effectively conduct a field investigation/testing program.[17]

Customer Complaints

Customer complaint programs, already the backbone of commission quality of service monitoring, will need to be broadened and strengthened to meet new demands. Commissions which do not have toll free numbers to file complaints may wish to add them. Sending commissions copies of all complaints received by a utility might be desirable, as well as an electronic record of all complaints, categorized in ways that allow development of meaningful statistics.[18] Complaint data gathered by commissions should be specific to both company and rule, so that regulators can know which rules are being violated most frequently by which companies.[19]

Customer Satisfaction

Customer satisfaction surveys are becoming more important as ways of measuring company compliance with customer expectations, although their validity and reliability still need improvement in many jurisdictions.

---

[17] Guy McDonald, Telecommunications Analyst, Kansas Corporation Commission, letter, Jan. 3, 1996.

[18] Commissioner Rowe, telephone conversation, Dec. 22, 1995.

[19] Taylor, e-mail, Jan. 5, 1996.

"After almost four years as a commissioner on the Colorado Public Utilities Commission, I have seen virtually no evidence from participants in our regulatory proceedings as to what customers want."[20] So wrote Commissioner Gary Nakarado in 1992.

In continuing to emphasize and improve protective regulation, commissions are heading towards a time when there is more focus on what customers want and less on measures of what companies are providing. Through better means of measuring consumer expectations and satisfaction, commissions can hope to gain a clear understanding of the quality of service issues that matter to telecommunications customers.

The transition to a network of networks and a competitive marketplace calls for more emphasis on finding out directly from consumers what their preferences are than does traditional protective regulation as practiced by state regulatory commissions. Yet as noted in chapter 3, customer satisfaction is difficult to measure, easily challenged in traditional regulatory processes, and, if conducted by the regulated utility, subject to manipulation to make the company look better. The substance and phrasing of questions and aspects of their administration, such as sample size and sample frame, can be adjusted to skew results in the company's favor. Telephone customers in the past have reported extremely high overall rates of satisfaction with their service. A consistent 95 percent satisfaction rate may be truly representative of how customers feel, or it may gloss over problems or pockets of dissatisfaction. Given the choice, commissions would prefer to rely on audited utility data for information on consumer satisfaction, but this is the sort of

In continuing to emphasize and improve protective regulation, commissions are heading towards a time when there is more focus on what customers want and less on measures of what companies are providing.

---

[20] Gary L. Nakarado, "Customer-Based Regulation: Could it Work if We Knew What Customers Wanted?" Paper presented at the 24th Annual Institute of Public Utilities, Williamsburg, Virginia, December 1992, unpublished Xerox, 1.

information that commissions are likely to have less access to over time, as is information from hearings. Complaint monitoring gives anecdotal evidence of problems but is neither valid nor reliable in the statistical sense. Some combination of focus groups and transaction-based surveys, preferably by telephone rather than mail, is likely to provide the best information on customer satisfaction with their telecommunications services.

Initial development of robust survey tools to aid commissions in assessing consumer satisfaction is likely to be costly and time-consuming. The Kansas Corporation Commission in 1995 investigated the possibility of using customer satisfaction surveys. Firms responding to a Commission request for information suggested prices in the range of $30,000 to $40,000 per survey.[21] Many commissions may not be willing or able to commit resources to such an endeavor. As a body of knowledge is developed, however, it may be possible for other commissions to build on it at less individual expense. As a beginning, commissions will be well served in attempting to find out what the regulated utilities are already using in the way of customer satisfaction surveys. By collecting that information statewide, as was recently done in Ohio, a commission can begin to see what companies are doing a better job of assessing their captive customers' preferences. Once a true market developed, of course, commission surveys of consumer satisfaction would no longer be necessary.

Despite the limitations of survey research, some commissions are already moving further into the realm of customer satisfaction measurements. Mississippi is currently introducing customer satisfaction surveys into its quality of service program. Mississippi's "Price Regulation Evaluation Plan" includes customer service

---

[21] Guy McDonald, e-mail communication, Jan. 16, 1996.

performance indicators based on customer satisfaction surveys.[22] The Commission is planning to make adjustments to an existing BellSouth survey. A California Public Utilities Commission survey of customers of Citizens Telecommunications Company recently "found a high incidence of service complaints and great customer dissatisfaction with the handling of billing problems."[23] The Commission penalized Citizens $330,000 for submission of incomplete and inaccurate reports and ordered the company to comply with a service quality assurance program.

In a period where downsizing and cost cutting are more likely than outright additions to staff, reallocation of existing resources within commissions may be called for.

RESOURCES

To carry out their increasingly complex service quality programs during the transition to the intermeshed network, commissions must have adequate resources. In a period where downsizing and cost cutting are more likely than outright additions to staff, reallocation of existing resources within commissions may be called for, as recommended by the 1995 Commissioners' Summit.[24] Staff who are trained for and comfortable with an emphasis on protective regulation will be needed to carry out commission responsibilities that are being brought into higher relief with the introduction of price cap regulation and the removal of barriers to

---

[22] Mississippi Public Service Commission, *Order of the Mississippi Public Service Commission Establishing a Docket to Consider Formulating a Properly Structured Price Regulation Plan for South Central Bell*, Final Order, Docket 95-UA-313, attachment: "Price Regulation Evaluation Plan, Nov. 1, 1995, 6-7.

[23] "California PUC Lowers Citizens Phone Rates, Including Reduction for Poor Service Quality," *NARUC Bulletin* 48-1995, Nov. 27, 1995, 9.

[24] NRRI, *Missions, Strategies and Implementation Steps*, 5.

competition. Staff within commissions who are used to dealing with economic regulation will need to shift towards protective regulatory skills. New hires should be considered for their ability to adapt to a changing regulatory environment, which may mean an emphasis less on accounting skills, for example, and more on skills in public policy implementation and customer service.

Commissions also need to consider the future fit of technical and customer service staff. In Florida, for example, Taylor envisions the consumer affairs staff being strengthened and the role of technical staff perhaps merging with consumer services. He reported that the different roles of the two types of staff sometimes cause confusion about what data are needed and how complaints are categorized. With full-blown competition, he suggests that these coordination and communication difficulties may not continue to be solvable through meetings between the two groups.[25] Reorganization may be called for, perhaps combining customer service and technical staff functions. Commissions in which the complaints for all utility sectors are handled by one unit may also want to consider separating telecommunications complaint handling from the other sectors, especially during the transition to competition. This might enhance the ability to track and deal with telecommunications industry complaints and increase the visibility of telecommunications customer service. The need for engineers may grow "as interconnection complaints become more common when end-to-end service is not satisfactory and there are four, five or more companies involved in the provision of service."[26]

Whether or not commissions develop standards for new services or whole new dimensions of service quality, they will need to attend to the possibility that standards should be revised to reflect new capabilities.

[25] Alan Taylor, e-mail communication, Dec. 6, 1995.

[26] Ibid.

STRENGTHENING THE STANDARDS THEMSELVES

In talking about strengthening protective regulation, thus far we have not mentioned the standards themselves. Standards should be clear, measurable, and based on open, collaborative rulemaking processes. McDonald suggests that "the more punitive the enforcement penalties, the stronger and more uniform a monitoring plan and indeed the standards themselves need to be."[27] Development of weighted service quality indices appears to be a good means of enhancing the rationality and impact of standards. Barbara Alexander has developed guidelines to aid in designing a quality of service index, including how to set baseline standards, track performance, and establish penalty levels.[28]

Commissions may also wish to consider new standards for new modes of communication, though not for the end-use services subject to competitive forces (e-mail, for example). Modem baud rates, for example, are a prime candidate for a new standard, at least until the network of networks becomes all digital. A high-quality connection is necessary to sustain high modem speeds and as residential as well as business customers hook into the Internet they should be assured of the connection's reliability. Some commissions may be limited by statute to regulation of voice grade services and may need to approach their legislatures for authority to extend service quality regulation as an integral component of their universal service mission.

Whether or not commissions develop standards for new services or whole new dimensions of service quality, they will need to attend to the possibility that standards should be revised to reflect new capabilities. Since the most visible characteristic of the telecommunications industry is the breath-taking pace of its

---

[27] McDonald, letter, Jan. 3, 1996.

[28] Barbara R. Alexander, "How to Construct a Service Quality Index in Performance Based Ratemaking," January 1996, unpublished paper.

adoption of new technology, the relationship between the adoption of new technology and quality of service is especially important to understand.[29] Proper use of the modernization decision rule ensures an increasingly higher quality of service at a lower unit cost for consumers. The modernization decision rule states that an investment in a new technology should be made if and only if the investment will increase the net future revenue stream of the firm. Review of the modernization literature reveals no examples of a new technology being adopted that lowered the level of reliability being provided. For commissions and consumers the expectation should ordinarily be that the quality of telecommunications services should increase with the adoption of new switches, glass fiber, and network configurations.

A central tenet of this report has been that "service quality" is a concept that may be more broadly construed than commissions have commonly done. For purposes of policy development, commissions may want to apply the expanded definition and analyze the implications for dimensions of quality that traditionally fall outside the purview of service quality standards. The Colorado Public Utilities Commission has proposed a "Telecommunication Consumers' Bill of Rights" to be considered in the Commission's proceedings on local competition. The bill of rights contains ten articles (see Table 6-1). The reader will note that all the dimensions of quality identified in chapter 2 may be identified in the Colorado manifesto. All of these areas are potentially the subject of additional policy direction, and perhaps standard setting. The table shows nine of the articles in the manifesto. The tenth reads: "All consumers will receive effective consumer protection by PUC complaint resolution, efficient monitoring and effective enforcement by the Colorado Public Utilities Commission."

---

[29] Lawton, "Network Utilization Principles."

TABLE 6-1
DIMENSIONS OF QUALITY AS THEY MAY BE IDENTIFIED IN COLORADO'S PROPOSED TELECOMMUNICATION CONSUMERS' BILL OF RIGHTS

Dimension of quality[a]	Provision in Bill of Rights
Availability	Equal opportunity to access basic and advanced services within reasonable time frames Continued free access to 911 in each county All numbers listed in a central directory
Reliability	Better quality services at prices comparable to today's price or less No reduction in transmission quality if different providers used
Security	Confidential conversations and transmitted data Nonlisted and/or nonpublished numbers Protection from unauthorized use of equipment, records and/or payment history
Flexibility/Choice	Increased choice of telecommunications provider(s) and services within reasonable timeframes
Simplicity	Network set up so that it appears seamless to the consumer Consumer able to make and receive calls using any provider without dialing extra codes Consumers able to keep their telephone numbers when they change provider(s) if they remain within their same neighborhoods.
Assurance	Ability to contact a consumer hotline staffed by each provider and affording the opportunity to solve problems.

[a] See chapter 2 of this report.

Source: "Colorado Staff Proposes Consumer Bill of Rights," *Telecommunications Reports* 61, no. 38 (Sept. 25, 1995): 26-27 and author's construct.

Universal service, in particular, may be an area for new standards. Richard Reese of the Public Utilities Commission of Ohio has proposed, for example, that universal service requirements be included among minimum telephone service standards.[30] A broad approach that would pin regulation to the most important aspect of quality in telecommunications, availability, has been proposed by one of the authors of this report, and will be discussed next.

From Price Regulation to Quality Regulation: The Minimum Subscribership Plan

Earlier, we explored a couple of proposals that would augment existing economic regulation by using the traditional standard-setting process to improve company incentives for service quality.[31] These proposals offer considerable improvement in the way in which quality has been traditionally regulated. We highlighted some of the difficulties, however, with identifying the relevant quality dimensions and designing an efficient incentive structure for a price regulation model.

Combining the concepts of common carriage and universal service, Blank suggests removing most local service price restraints while imposing a binding minimum constraint on the number of residential telephone subscribers to the local network.

---

[30] Richard Reese, "Minimum Telephone Service Standards and Universal Service, undated Xerox.

[31] See Lynch, Buzas, and Berg, "Regulatory Measurement;" and Noam, "The Quality of Regulation."

Larry Blank proposes a complete change in the way the local telephone industry is regulated.[32] Combining the concepts of common carriage and universal service, Blank suggests removing most local service price restraints while imposing a binding minimum constraint on the number of residential telephone subscribers to the local network. The plan would be applied to a particular, local geographic area. Regulators monitor subscribership levels in the area to determine compliance with the mandated target. With credible penalties for noncompliance, such as renewed price regulation, the local exchange company is forced to select prices and qualities across the various services available on the network in such a way as to attract and keep satisfied the number of subscribers targeted by regulators.

On theoretical grounds, Blank demonstrates that service prices will be effectively constrained under this "minimum subscribership plan" (MSP), a finding supported by recent empirical studies.[33] Among several other important features of the plan,[34] the finding most relevant for our discussion is that MSP unambiguously induces higher service quality when substituted for a price restraint. It is argued that the plan is also superior to a service quality price factor in certain key aspects. The MSP conforms to the Kihlstrom-Levhari principle that incentive regulation "must involve prices which are sensitive to quality variations" and induces price adjustments that just equal actual subscriber demand-price changes. That is, service prices change in response to quality change only insofar as customers value

---

[32] Larry R. Blank, "The Minimum Subscribership Plan (MSP): Quality, Prices, and Current Policy," paper presented at the 23rd Annual Telecommunications Policy Research Conference, Solomons, MD, Oct. 2, 1995.

[33] See Jerry Hausman, Timothy Tardiff, and Alexander Belinfante, "The Effects of the Breakup of AT&T on Telephone Penetration in the United States," *American Economic Review, Papers and Proceedings* 83, no. 2 (1993): 178-184; Brooks Albery, "What Level of Dialtone Penetration Constitutes 'Universal Service'?," *Proceedings of the Ninth NARUC Biennial Regulatory Information Conference* (Columbus: NRRI, 1994); and Ross C. Eriksson, David L. Kaserman, and John W. Mayo, "Targeted and Untargeted Subsidy Schemes: Evidence from Post-Divestiture Efforts to Promote Universal Telephone Service," Working Paper (Knoxville, TN: University of Tennessee, 1995).

[34] For example, MSP directly and more efficiently addresses universal service goals.

that change. Furthermore, MSP encompasses all relevant quality characteristics valued by customers, not just those selected by a regulatory agency.

Consider a price ceiling on monthly, flat-rate telephone service as displayed in figure 6-3. The demand for telephone service is represented by the downward sloping curve, denoted *q(p)*, and the price ceiling is given by the horizontal line, denoted PCAP. We assume that the company is subject to common carriage requirements such that all demand at the current price must be supplied with nondiscriminatory rates. We could replace the price ceiling with a minimum output requirement, or in this case a minimum subscribership level, represented by the vertical line, denoted MSP in figure 6-3. Clearly, when demand is downward sloping and service quality is not variable (or is otherwise directly and completely controlled by the regulator), the two regulatory constraints, PCAP and MSP, provide identical results in terms of flat rate and output.

It seems unreasonable to assume that all service attributes are fixed or are in no way influenced by company decisions. (In fact, this is one of the underlying reasons for this report.) Therefore, we introduce variable quality to the model. With variable service quality, it may be formally demonstrated that MSP leads to higher quality than PCAP. (Recall that price cap regulation generally leads to socially suboptimal quality provision.) To see why MSP encourages higher quality than PCAP, return to figure 6-3. The arrow along the horizontal PCAP line indicates the most profitable path available to the company when it shifts demand through a quality improvement. Greater gains to the company from quality improvement, however, would be realized if it could increase price such as indicated by the arrow along the vertical MSP line. The firm constrained by PCAP must alter output production, and therefore cost, to accommodate any change in quality (shift in demand). Thus,

> Replacing the flat-rate price cap with MSP at the current subscribership level unambiguously encourages the company to innovate and enhance service quality. Furthermore, MSP prevents inadequate service provision to the household at greatest risk of dropping from the network.

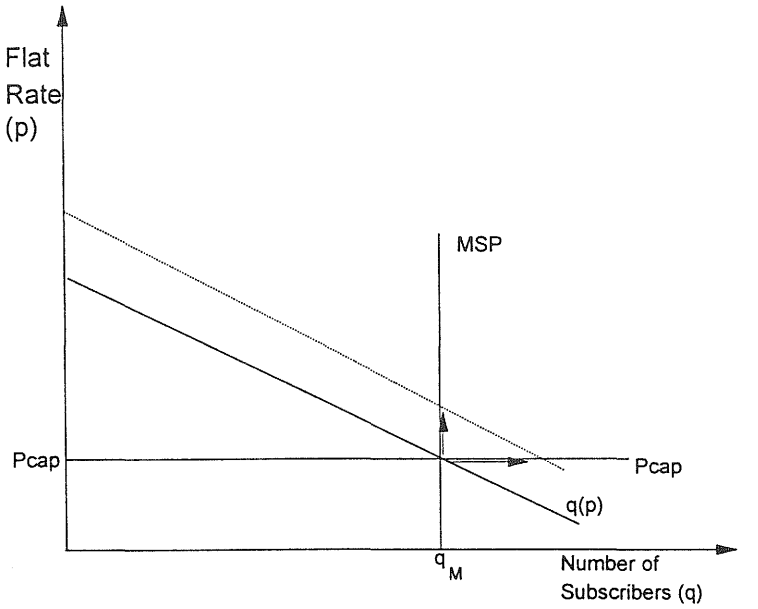

Figure 6-3. Price cap versus minimum subscribership plan.

Source: Author's construct.

there is an indirect cost associated with quality improvement because the common carrier constrained by a price ceiling must also increase output. On the other hand, the price-constrained firm has greater flexibility to profit from quality deterioration because output (subscribership) can be reduced. Just the opposite is true for MSP. Since the firm must maintain the network subscribership level following any reduction in quality, the MSP-constrained monopolist has less flexibility to profit from lower quality because price must fall; but greater flexibility to gain from quality enhancement valued by customers because price is allowed to increase under MSP. Note that the direct marginal cost of quality is invariant to the regulatory constraint choice.

Therefore, replacing the flat-rate price cap with MSP at the current subscribership level unambiguously encourages the company to innovate and enhance service quality. Furthermore, MSP prevents inadequate service provision to the household at greatest risk of dropping from the network.

As discussed above, the modified price cap plan with a service quality factor can result in higher quality than conventional price cap regulation. The advantages of MSP over a modified price cap scheme are:

1. The regulator need not identify and measure quality dimensions.

2. MSP has a built-in (endogenous) price adjustment for quality change which is just equal to the marginal subscriber's valuation of quality improvement. The firm cannot be overrewarded, which would result in reduced telephone subscribership.

3. All relevant quality dimensions are encompassed by MSP incentives, not just those identified by companies or regulators. Relevant quality dimensions are defined here as those valued by customers, and company incentives are based on actual cost and demand aspects of the quality dimension, not on imposed regulatory standards and weights.

4. The company can implement quality innovations as technology develops without asking regulators to adjust an existing quality factor.

One shortcoming of MSP is that the scheme does not guarantee socially optimal quality levels. Whereas price restraints tend to encourage suboptimal quality, MSP can result in socially too much quality. (See the discussion of monopoly quality provision when output is fixed in chapter 5 and figures 5-1 and 5-2). Another shortcoming of MSP is its radical departure from current price regulation. Regulators would have to substantially reallocate their resources to adopt this completely new regime. Clearly, MSP should be viewed as a proposal that would require far greater institutional change than the quality incentive proposals discussed above.

The improved quality incentives from a switch to MSP come without sacrificing the efficiency attributes of price cap regulation. The firm under MSP is encouraged to produce efficiently using least-cost inputs and input combinations. The multiple-service pricing properties of MSP are found to place greater weight on

low-end (marginal) customer needs relative to Ramsey pricing while minimizing the possibility of cross-subsidization.[35]

Informing and Educating Consumers

Strengthening protective regulation and perhaps even moving to a MSP that reverses the existing emphasis on price regulation over quality regulation are approaches to dealing with both old and new issues in monopoly provision of telecommunications services. We have also identified many emerging issues affecting various dimensions of quality that arise because of competition, or are common to monopoly and competitive market structures (Table 2-4). Some of these, such as establishing number portability, will be solved by one-time policy decisions. Others may call for ongoing oversight and possibly standards.

Commissions are also looking for new ways of educating consumers so that in the intermeshed network consumers are better able to decide among conflicting, confusing options.

Letting customers know what their quality choices are is a legitimate government function widely used for other industries besides telecommunications. Commissions are also looking for new ways of educating consumers so that in the intermeshed network consumers are better able to decide among conflicting, confusing options. Given the prospect of more providers for more complex packages of services, some of them old, some new and some not yet invented, ascertaining customer desires is far too complicated for a central authority to take on, and unnecessary except for services that continue to be provided by a monopoly local exchange carrier. What is a legitimate role for government, however, is provision of information. Healthy competition depends on consumers being well informed about their choices, and not only about price but about quality.

---

[35] Blank, "The Minimum Subscribership Plan (MSP)."

To the extent that information acquired through the market is imperfect, government action is appropriate to correct that failing. Consumers can then better exercise their votes in the marketplace. The provider that is counting on brand-name loyalty and the preference of consumers for one-stop shopping will have to rely on other quality factors besides "assurance" to retain or acquire market share.

Reporting Quality Performance

Commissions already do much to inform the public about quality of service performance. The NARUC Subcommittees on Consumer Affairs and Communications have been working to establish a data base of consumer education and other advisory materials prepared by state commissions.[36] Consumer complaint data received by commissions might also be published, perhaps on web site bulletin boards, so that comparisons are at the fingertips of consumers.[37] The press, of course, will continue to be an important tool for informing the public. Commissioners, staff involved in service quality, and public affairs staff will need to make special efforts to inform the public, through the media, of consumer choices and questions they should ask during the transition to competition.[38]

The potential also exists to go beyond existing programs to aid consumers in sorting out the claims of providers and making well-informed choices. One interesting opportunity for developing standards is to forego particular ones, but merely to publish industry results and allow the consumer, now armed with performance and cost information, to make determinations for themselves about

---

[36] "Index of Consumer Alerts: Proposed for Subcommittee on Consumer Affairs and Communications to Cooperatively Establish an Electronic Information Exchange," Feb. 26, 1995, unpublished one-page Xerox.

[37] Taylor, e-mail, Jan. 5, 1996.

[38] McDonald, letter, Jan. 3, 1996.

the tradeoff between price and quality. This approach would be similar to that taken on airline takeoffs and landings or nutrition labeling and is distinctly a public standard-setting endeavor since it may not be in the industry's own interests to collect and publish these statistics. Industry, despite the political rhetoric, seeks to avoid direct competition. Publishing comparative statistics also has the effect of avoiding setting a quality level too high and unjustifiably excluding substitute products from the marketplace.[39] Even the Underwriters' Laboratories does not compare product safety but merely concludes whether a product is safe or unsafe.[40] This approach also has the benefit of avoiding public justification of the standard in a court of law, which would be costly to both the public service commissions and the industry. By merely providing comparative information, public sector agencies need not define and defend causal links when information about their relationship is unavailable or unclear. In the case of telephony, it may be far easier to publish comparative standards, since identifying a causal connection between particular performance standards and service quality outputs is especially difficult in this continually changing and highly complex industry. The only question is whether consumers will know what to do with the information that is supplied to them. Will it make sense to them? Will they be able to make tradeoffs between cost and the quality of service?

Public sector agencies have a clear advantage in the areas of applied research and collecting information. There are no economic reasons why industries would take it upon themselves to publish quality of service information.

---

[39] An official from the Carter Administration observed that, "A single quality level standard if set too high may unjustifiably exclude substitute products from the marketplace. Pass/fail standards may also blunt the incentive for further product development and innovation," Cheit, *Setting Safety Standards*, 229.

[40] Ibid., 230.

Public sector agencies have a clear advantage in the areas of applied research and collecting information. By having the government collect information, we overcome the "free-rider problem" associated with the public good nature of information. As noted earlier (chapter 4), private sector organizations tend to avoid collecting this type of information since what they know may hurt them. Collecting relevant information has been a prerogative under traditional regulation and government agencies would therefore enjoy the benefits of experience. Should the public sector decide to collect this information, the organizational unit responsible for data collection should be separate from the one enforcing the regulation. A good example is National Safety Transportation Board and the Federal Aviation Administration (FAA). The person promulgating airline safety regulations and investigating accidents or near misses is not the same. If the "free rider problem" is merely one of costs, chances are that industry would gladly pay.

One of the fundamental assumptions in the new network-of-networks paradigm is that there will not only be increased competition within an industry but also competition among technologies and industries. Another potentially interesting area for public sector involvement is reporting the relative performance across several industries. Typically, standards setting is done within an industry. This means that effective comparisons across industries are never done because there are no standards organizations which span these industries. While ATIS has only recently started to include cable providers as part of its membership, standards setting is still done by each industry separately. To genuinely enhance the integration and true competition of the several technologies which are now seeking participation in the network of networks, publishing comparative standards on each of these industries is a distinctly public sector niche.

There are no economic reasons why industries would take it upon themselves to publish quality of service information. Yet the marginal costs such a system would impose on companies is likely to be extremely low if they are already collecting it as a normal part of the management function. One option is to invite

voluntary compliance so that companies which do, in fact, provide quality service could use these measures as a marketing strategy. Still, public service commissions must realize that companies will want to avoid direct comparisons and direct competition by gaming the process. Recall how the FAA, in trying to make comparison information available to consumers, tried to report on-time records as a means of reducing the declining quality of service in the airline industry. Airlines responded to this requirement by increasing the estimated amount of time it took to travel between two points. As a result, flights suddenly began to show up early or on time.

LABELING QUALITY

Even now, while consumers for the most part have no choice as to the service provider, it may help them if they are given a clearer idea of the level of service they are receiving. Intelligent comparisons will depend on developing standardized measures that consumers find understandable. Today and for the foreseeable future, residential and most business customers do not have the necessary information or expertise to correctly differentiate between providers offering different levels of quality. Claims and counter claims about the reliability of the services are beyond the capability of the average business and residential consumer to sort out, unless they buy each service. This trial-and-error mode is expensive for residential consumers and could even be disastrous: What if the enhanced emergency service (E-911) customers thought was included turns out not to be available in their discounted low-end service. Possession of accurate information about telecommunications services is an important condition if competitive markets are to quickly evolve and mature.[41]

---

[41] One indication of this information dilemma is the difficulty consumers have had in evaluating the claims of carriers in television and newspaper advertisements about which one offers the best prices, quality, and service offerings. While commercial computer programs and consulting

Ideally, an approach might be designed that relies on cooperation between industry and government to better inform customers of their quality choices in telecommunications services. Such an approach could be structured to meet universal service goals, be appropriate for a transitional telecommunications market, and encourage competition, consumer choice, and innovation. It would be aimed at providing inexpensive and reliable information that consumers can use in making their telecommunications purchasing decisions. The aim would be to establish a system to categorize service according to overall levels of quality, similar to grades of meat or nutritional values.

Ideally, an approach might be designed that relies on cooperation between industry and government to better inform customers of their quality choices in telecommunications services. The aim would be to establish a system to categorize service according to overall levels of quality, similar to grades of meat or nutritional values.

In such a hypothetical labeling system, all providers, except the eligible telecommunications carrier or carrier of last resort, could select whichever quality category or categories they want to meet.[42] The only requirement would be that the services must be clearly and accurately labeled. The telecommunications provider designated by the commission as eligible for universal service funds would have an obligation to provide an agreed-upon set of services that meet commission quality standards. Residential, business, and all other customers would be free to

---

firms are available to determine the telecommunications provider that offers the best price for a particular firm (based on an analysis of its calling patterns and requirements), for all practical purposes this is not an option available to residential or to small- or medium-sized businesses or agencies. Alternatively, Eli Noam sees an emerging role for a "systems integrator" who would help consumers to find and use the telecommunications system that met their needs. See Eli M. Noam, "Beyond Liberalization: From the Network of Networks to the System of Systems," *Telecommunications Policy* 18 (1994): 687-704.

[42] The eligible telecommunications carrier could be allowed to provide several tiers of service such that all customers can readily and easily obtain service that meets commission standards in one tier, but yet have available to them other levels of quality in another service tier. This would allow the essential services carrier also to be innovative in the package of services it provides to consumers.

choose among the quality levels. They would be better off because they have more choice than before and because the categories would be simple and meaningful.

Four levels of quality might be distinguished for the public switched network: "superior," "standard," "market," and "none." Telecommunications services labeled *superior* would exceed existing consumer expectations by an agreed-to increment. For E-911, for example, a superior service offering might have its base level E-911 emergency service enhanced by a computer-generated map that would be instantly sent to the nearest fire station showing the fastest route to the customer's house when calling in to report a fire. *Standard* service would be an E-911 service where the operator sees the name and address of the customer and then acts to activate the local fire station. The eligible telecommunications carrier must, accordingly, equip all of its lines and switches to support this feature at an agreed-upon price. The option to provide standard quality of service would be open to all; a competitor might decide for business reasons that it also would provide the same standard E-911 service, rather than a premium service.

A service labeled as fitting in the *market* category would be used in situations where higher standards could be identified and did exist, but which were explicitly not being met or intended to be met by the provider. The basic thought behind this category is that a significant number of consumers would prefer, presumably, to save money by paying for and receiving a lower grade of service than the standard level provided by the eligible carrier. Continuing the emergency services example, the customer buying the clearly labeled market service might only have access to an emergency operator, but the operator would not have their name and address available electronically. Other examples might include higher call blocking probabilities, longer time for operator services, or being in a lower service response or repair category.

Where the collaborative process found standardization was premature or unnecessary the quality label would be *none*, meaning that no standards exist, at least for the time being. This category might be especially useful in encouraging

innovation while informing consumers that they would be assuming some risk in signing up for the service. Unless demand crossed some threshold, government would be under no obligation to initiate proceedings to develop standards.

The goal of the labeling approach is to inform consumers without confining them, as now, to one category. Societal interest in universal service is preserved because affordable standard service is available to all who wish it. Indeed, if the standard level of quality in fact reflects the price/quality/service variety preferences of a significant number of consumers, then we may expect that multiple providers would seek to include a standard service offering in the package of telecommunications services they offer for sale. Migration of standards is possible as today's premium, or superior, services become tomorrow's standard services. There could also be a migration where actual demand indicates that the lower standards furnished for a particular service better reflected society's universal services preferences and *market* might become the new standard.

Development of a labeling system for telecommunications services would be complex and implementation difficult. This might best be done at the national level. The system would have to be structured in a way that encouraged continued technological and marketing innovations, rather than freezing progress in place.

Taking a Proactive Role in Industry Standards Setting

The terms on which new or existing entrants compete in the information age are frequently being decided in the arcane debates of standard-setting bodies. One immediate reason why commissions will want to become involved with standards setting is that under the 1996 federal telecommunications reform, state commissions will find themselves faced with technical interconnection issues. The legislation provides that commissions will be referees in conflicts over

interconnection, a role that is appropriate, but will be difficult, and will certainly involve an understanding of both consumer-driven and technical standards.

Beyond monitoring or attending standard-setting activities to keep abreast of important developments, commissions may want to go further and determine if there is some type of role that commissions can take on to improve the standard-setting process.

Government should monitor the activities and developments of standard-setting organizations. This would not be an unusual position. Government agencies providing law enforcement and emergency services now monitor and even participate in specialized areas of standards setting. Also, many companies now participating in standards setting simply do so to observe the discussions so that they can understand the direction and pace in which technologies are developing. Interconnection issues will require that commissions understand technological changes. It is true that monitoring or even attending conferences about standards is an expensive proposition, as was discussed in chapter 4. Commissions may want to pool their resources and fund staff to inform the commissions about important developments in standards.

Beyond monitoring or attending standard-setting activities to keep abreast of important developments, commissions may want to go further and determine if there is some type of role that commissions can take on to improve the standard-setting process. As mentioned earlier, standard-setting bodies are under increasing strain to develop "public" standards before proprietary standards are developed. "Public standards" or "open systems" can encourage competition and reduce the royalties that would be owed for the company owning a copyright or patent protecting a proprietary standard. Commissions may want to investigate whether any laws exist which constrain the success of VSOs in developing public standards. For example, many of the procedures used by standard-setting agencies are employed to prevent claims of antitrust violations. Close and open inspection of the existing procedures may uncover what is truly necessary to democratize discussion and what is unnecessary and exists merely to avoid lawsuits (and reduce

how effective these standards organizations are). At the same time, as discussed in chapter 4, there are many unanswered questions about how well the standards process promotes competitive markets which operate in the public interest. Why is there such a close correlation between the level of participation and the likelihood of having one's own standard adopted? If this is true, how do smaller companies and organizations participate? Can they truly affect the decisions about which standards are to be adopted? In an age of competing technologies and competing industries, what is the relationship between the standards organizations that represent different industries? How well does the liaison work among standards organizations to ensure that services are interchangeable and that interconnection and competition will take place (for example, among satellite, cable, wireless, and fiber)? Will the standards adopted allow for fungibility in the services provided by these providers or will we have more lines into the home? More research should be done on understanding both the economics and the politics in and among standard-setting organizations.

The exact role that government should take is a very sensitive question. The top-down Bell paradigm is gone and has been replaced by a democratic, grass-roots Internet approach where no particular entity is in charge. Finding an appropriate balance in the standard-setting process will require innovative solutions.

It is also clear that there is little representation of consumer interests in these standard-setting bodies. Commissions should be sure that they are comfortable with the idea that competing business interests in standard-setting bodies are a good surrogate for representing consumer interests. If they are not comfortable with this assumption they should understand better how standard-setting bodies operate and even participate in the standard-setting bodies to make sure that consumer interests are represented either by subsidizing these interests or directly representing them.

It is important to understand that the exact role that government should take is a very sensitive question. The top-down Bell paradigm is gone and has been

replaced by a democratic, grass-roots Internet approach where no particular entity is in charge. In the Internet world, any mention of government involvement is looked upon with horror. But while the system governing the Internet works well to provide short-term solutions, the National Research Council points out that the long-term vision suffers and it is doubtful that industry alone can articulate standards to meet the engineering needs of future networks. An important belief central to the "Internet world-view" is that no one can predict even a few years into the future what kinds of technologies will be popular. Any attempt to do so is foolhardy and possibly damaging to the long-term growth of the industry. At the same time, it is clear that values like democracy, freedom, and equal access will always be important and that government is entrusted to protect these values regardless of what technology is developed. Finding an appropriate balance in the standard-setting process will require innovative solutions.

While it is certainly clear that the Internet is a success and that business is eagerly awaiting the many opportunities to increase productivity, it must be remembered that the Internet was started through funding from the Defense Department's Defense Advanced Research Project Agency and later through funding from the National Science Foundation. In the same way, the federal government's National Research and Education Network project is investigating tomorrow's broadband network technologies. One clear role for government is to fund research which can provide the technical knowledge to support the goals of the National Information Infrastructure that would not otherwise be done. The National Research Council notes that many of the issues important to the development of tomorrow's network, like network management and the development of an informed market of providers and consumers, require the development of technologies that can measure and report varying levels of quality

of service.[43] Commissions may want to participate more actively in these areas if they are to continue to represent their states' interests in education and economic development.

LESSONS FROM OSHA EXPERIENCE

If commissions were to venture further into consumer quality standard setting, they would need to be sensitive to the pitfalls of the past, such as the early days of the Occupational Safety and Health Administration discussed earlier in this report.

Applying the lessons of OSHA to quality of service for telecommunications standards reveals some interesting similarities. Many current quality standards are technical in nature and developed by companies to manage the public switched network. A commission attempting to adopt quality standards may have limited expertise, as did OSHA, in assessing the technical efficacy of these standards (especially in the case of interconnection standards). As with OSHA, there would be a great temptation to adopt industry standards wholesale, and like the OSHA case, these standards might quickly become obsolete, in light of the furious pace of change in the telecommunications industry. While technical expertise is not a problem on the private side, the problem with adopting preexisting standards is that companies might not feel obliged to follow them, and, therefore, would have less of an interest in making sure that they are good standards. If a state regulatory commission were to adopt industry standards, it would need the technical expertise to make sure that these are sound standards

If commissions were to venture further into consumer quality standard setting, they would need to be sensitive to the pitfalls of the past.

---

[43] National Research Council (U.S.), NRENAISSANCE Committee, Leonard Kleinrock, Chair, *Realizing the Information Future: The Internet and Beyond* (Washington, DC: National Academy Press, 1994).

and ones that the industry has a mutual interest in adopting (but presently does not because of the free rider problem). In addition, close monitoring of these standards would be necessary given the rapid obsolescence of technology.

A second parallel is that of applying standards developed by one industry to all industries–a "one size fits all" strategy. With the many industrial players now converging on the many telecommunications services to be provided, one standard may not appropriately fit all; in fact, customers may choose various levels of service at various pricing levels. The difficulty is that choices by a company in the provision of service may have externalities for others' decisions.

The final parallel with the OSHA experience is the ability to define quality. As mentioned earlier, the OSHA authorizing language was nebulous, invoking very vague language such as the law requiring OSHA to develop standards which are "reasonably necessary" and "to the extent feasible." The consequences of this were numerous political battles over the interpretation of this vague wording. This was exacerbated by the aversion to cost and benefit estimates because of the widely varying assumptions about what it would take to comply with those standards and their resulting benefits. Defining "quality of service" is even more problematic because of the difficulty in conceptually framing what "quality" is over and apart from that necessary to make the public switched network operate or what can be perceived and serve as a basis for market decisions. At least in the case of OSHA, there are biological models underlying the decisions, based on empirical research on animals and humans, although the model predictions are highly sensitive to the numerical assumptions made. A collaborative process among the relevant parties is one solution. By focusing on the performance measures, commissions would not be required to develop definitions and justification for the rules and standards.

Although ATIS does have the NRSC, reliability is different from quality, and as of yet, ATIS has not explicitly focused on quality standards.[44] What remains to be determined is whether an explicit focus on quality is necessary over and above what is probably one of the many goals already considered in creating good standards. One interesting avenue for investigation is whether the joint provision of services by multiple providers is made more difficult because of the lower quality service provided by a subset.[45] Higher quality service providers may be subsidizing lower quality service providers and may want credit for their efforts through service quality indicators or standards. The lack of quality standards may be explained by the fact that it is unnecessary, or companies do not want real competition with real scores and indices showing their level of performance. If the latter is true but standards would allow regulators and consumers to measure quality service, public service commissions may ask ATIS to develop them. Looking back at the experience with OSHA, however, it is probably a good idea that the commission have its own strong technical support staff. Other explanations for why quality standards have not been developed include: (1) the cost of developing certain standards, though necessary, might be too high for the private sector; or (2) the long-term benefits of developing a standard might not be effectively recognized by the market. Again, it may be necessary for a public service commission to develop this public good even though it is not in the interests of individual firms to develop these standards.

---

[44] William Lehr, ed., *Quality and Reliability of Telecommunications Infrastructure* (Mahwah, NJ: Lawrence Erlbaum Associates, 1995).

[45] National Research Council (U.S.), *Realizing the Information Future*.

As mentioned earlier in this report, the most important force driving private sector organizations to adopt standards is to forestall litigation. VSOs see this is as an alternative to intrusive public sector legislation which limits managerial discretion and initiative. If this is the case, it is in the public's interest to make sure that the legal system operates correctly. If a service provider does not offer an adequate level of service, contract law, tort law, and antitrust law must be available so that people harmed by an inferior level of service can detect and identify the causes and the parties responsible for poor quality service for actions that the law would consider actionable. But courts of law would need to have some "community standard" (a "reasonable" level of service provided by an average provider) to be able to make informed judgments in tort or contract actions. If this community standard is not known or not very well developed, it may be too expensive or difficult for some litigants to develop this information on their own. Developing baseline information about community standards of quality telecommunications service would go far in reducing legal costs and adding predictability to court decisions for both consumers and the telecommunications industry.

Developing baseline information about community standards of quality telecommunications service would go far in reducing legal costs and adding predictability to court decisions for both consumers and the telecommunications industry.

At the same time, the legal system can freeze innovation. Industry may not innovate lest evidence of new and better industry standards be admitted in evidence in contract, tort, or antitrust actions to impose liability on those industries which did not perform at the level of the standards. Hence, there is a real disincentive by trade organizations and VSOs to innovate or publish new standards. Legislation would need to be passed or rules issued that allow for "ordered innovation" of the community standard.

Public service commissions should also investigate whether consumers should have more input procedurally into the standard-setting process. While consumers are not limited from participating by VSO bylaws (de jure), in fact (de facto) the costs are much too high for them to participate.[46] Even public service commissions are not involved because of the costs in developing and funding qualified technical personnel to attend these meetings. Minimally, there could be a representative of public service commissions to monitor the proceedings of standard-setting bodies to ensure that there is at least some measure of representation of the public's interest, beyond law enforcement and emergency services. NARUC does have a representative assigned to the Network Reliability Council, which has some responsibility for telecommunications service quality. Perhaps NARUC could call on industry forums to include a representative from the state commissions in their deliberations. State regulatory commissioners already sit on the boards of the Electric Power Research Institute, Gas Research Institute, American Water Works Association Research Foundation and Bellcore.

CONCLUSION

In this chapter we have suggested steps that might be taken to improve the likelihood that consumers will be well served on all important dimensions of quality during the transition to an intermeshed network and afterwards. The suggestions broached here have ranged from the sublime to the mundane and from the unlikely to the highly feasible. Whether a commission is prepared to consider implementation of the MSP or to initiate improvements to complaint management, the list of ideas is intended to be thought provoking and contribute positively to the policy debate currently underway in the regulatory community.

---

[46] According to M. Whiting Thayer of the FCC, at least one consumer does participate regularly in industry forums, financing the effort by publishing a newsletter.

CHAPTER 7

SUMMARY AND RECOMMENDATIONS

High-quality telecommunications service has been all but taken for granted in the past and should continue to be the norm in the United States in the future. The trend in markets, technologies and federal and state legislation is towards a far greater choice of services, a de facto indicator of quality and a condition allowing consumer control over the types and amount of quality desired. Yet reaching an approximation of competitive Utopia, with its plenitude of consumer benefit packages, is neither assured nor easy. Even if this happy state is achieved, there may well be a continuing need for the exercise of government authority, as with other industries, many of them less vital than telecommunications. We have identified three separate areas of control of telecommunications quality of service–industry standards, market controls and government agency controls through economic or protective regulation–and have called for consideration of a variety of policy changes.

Reaching an approximation of competitive Utopia, with its plenitude of consumer benefit packages, is neither assured nor easy.

We have used a broad-brush definition of service/quality throughout the report, emphasizing that any service is imbued with many dimensions of quality that make up the consumer benefits package people purchase. Availability, reliability, assurance, security, choice and simplicity are all elements of telecommunications quality. Not all of these are necessarily amenable to the same form of public policy approach, such as standards setting. Nor will the public manager designing practical programs wish to combine oversight of all these functions in one organizational unit. By listing the quality dimensions and noting

that technology, monopoly, competition, and interconnection have raised quality issues for almost all of them, we have attempted to articulate the complexity of service quality problems that face telecommunications regulators throughout the country.

Industry Controls and Quality

Some of the most important decisions on telecommunications service quality, determinations that will affect consumers for years to come, are being made through processes that promote victory for the most powerful players, not necessarily the best or most economically efficient ideas. The process of identifying and agreeing on industry standards is complex, political, and not necessarily internally democratic. Decisions on who gets what, when, and how are constantly being made by participants with varying levels of power. Nor is it responsive in any direct way to the public. For good or ill, consumer interest is assumed to be represented through company interests. Policy makers need to understand the standard-setting process because the results are not purely technical, but are political outcomes with important impacts on society. They set the conditions for participation in the network of networks.

VSOs have been formed by users and producers in the telecommunications industry to debate and adopt standards. The process is cumbersome and slow. Most important, consumers are notably absent from the discussions. And today, many decisions that affect the public switched network are being made outside the standards organizations, where protocols are developed on a "whoever thought of it first" basis. In neither case–the rigid, slow processes of VSOs nor chaotic development–are consumers represented

The process of identifying and agreeing on industry standards is complex, political, and not necessarily internally democratic. Decisions on who gets what, when, and how are constantly being made by participants with varying levels of power.

consistently and adequately. The public has a strong interest in the development of a network of networks that ensures reliability, and is neither held hostage to weak links nor the subtle exercise of monopoly power that sets the parameters for millions of electronic transactions.

Market Controls on Quality

Companies compete on the basis of quality as well as price, and economists tend to agree that increased competitiveness generally leads to increased experimentation with levels of quality. This is to the benefit of consumers, who can choose the types and amount of quality they want at the prices offered. A protected monopolist lacks incentives to fully respond to the potentially wide range of consumer preferences for quality. Thus, despite some potential drawbacks of competition, such as brand proliferation that may be used by incumbents to attempt to block entry, customers are better served by competition than by monopoly. The greatest limit to the efficient functioning of a competitive market may be deficiencies in the information available to investors and consumers.

Companies with monopoly power are likely not only to provide less variety in the services they offer, but to distort levels of quality and discriminate against low-end customers. Whether the monopolist provides lower or higher quality than demanded depends on whether the services are substitutes or complements. At a fixed output, when output and quality are demand substitutes, the monopolist selects a lower than optimal level of quality; when output and quality are demand complements, a higher than optimal level. The monopolist reduces quality for the consumer at the low end of demand not out of a direct desire to do harm, but because this enables extraction of more consumer

Given the opportunity, the telecommunications firm that retains substantial market power will attempt to reduce quality for users of basic services in order to encourage the purchase of better service by those able to afford it.

surplus from the high-end users. This is a particularly important point to remember for public utility regulators: Given the opportunity, the telecommunications firm that retains substantial market power will attempt to reduce quality for users of basic services in order to encourage the purchase of better service by those able to afford it.

Economic and Protective Regulatory Controls on Quality

As the form and applicability of economic regulation changes, commissions have been strengthening protective regulatory controls on quality and tying them more closely to economic regulation. Staff at 32 commissions participating in an NRRI survey conducted in the spring and summer of 1995 reported many reasons for initiating or revising quality of service standards in their states. The primary reasons were new technology and the actual or potential deterioration of service quality. The propensity of price regulation to encourage reductions in quality is a major concern among public service commissions. Fourteen jurisdictions had tied their new or revised quality of service standards to an alternative regulation plan. In some cases, a price cap formula includes a service quality factor.

Weighted indices of quality are being used in at least four states. An overall quality index improves over traditional standard setting by making commission decision making easier once the index is developed and agreed to and allowing companies flexibility in how they meet service quality requirements.

Commissions use several means of monitoring the quality of service offered by jurisdictional telecommunications utilities. These include company reports, customer complaints, field investigations and customer surveys. Enforcement of violations is problematic, however. Sixteen respondents to the NRRI survey reported problems enforcing standards. The biggest single hindrance they identified was lack of staff to monitor and evaluate company performance. Commissions' ability to put teeth into quality of service standards is also inhibited by the strength

of company opposition, difficulties in commissions standing up to that opposition, barriers to acquiring information from the companies, and vague standards. Staff at only half of the commissions surveyed reported unqualified satisfaction with the job their standards were doing, suggesting that there is considerable room for improvement.

Whatever the form of regulation of quality, whether it is traditional standard setting, standards tied to price regulation, or a weighted index, inadequate information can make oversight imperfect.

Whatever the form of regulation of quality, whether it is traditional standard setting, standards tied to price regulation, or a weighted index, inadequate information can make oversight imperfect. Not all relevant service characteristics can be easily measured, and, even when they are, neither the costs of supplying quality nor the demand customers have for quality can be evaluated with any accuracy.

Advantages and Disadvantages of Market Controls, Industry Controls and Regulatory Controls

The omnipotent policy maker choosing among the three overall approaches to service quality far from the hurly-burly world of influence and intrigue where such choices are actually made no doubt would like to have some sense of the costs and benefits of each approach before locking them into place. Many of the factors to consider in such an evaluation have been hinted at along the way to this penultimate section of the last chapter. They include: (1) meeting consumer demand for quality, (2) improving industry economic performance, (3) adaptability to change and fostering of innovation, (4) low administrative costs, (5) ability to meet industry demand for quality, (6) achievement of equity objectives, (7) economic development, and (8) ability to measure impacts. This is a long list that could perhaps be even longer. Not every factor has equal weight. Furthermore, a thorough analysis would look at each of the six dimensions of

quality of service individually for each of the eight factors in order to assess the cost-effectiveness of the three approaches. We will not conduct a Talmudic discussion of how control mechanisms stack up for availability, reliability, security, simplicity, flexibility/choice and assurance here, having probably already taxed the reader's tolerance for such analysis. The report would not be complete, however, without some comparisons.

Even a cursory look at the relative advantages and disadvantages of the control mechanisms leads to the conclusion that, compared to the other two, a market standard has impressive pluses. For the first four criteria listed above, effective competition (if it can be attained) is the preferred means of achieving quality. Administrative costs would be low to nonexistent. The ability of firms in competitive markets to align themselves with real consumer preferences and in the process to maximize flexibility and choice is unsurpassed. Many telecommunications firms are already competing on the basis of quality. Bell Atlantic has promoted its reliability. Ameritech has run radio advertisements suggesting one-stop shopping for all the consumers' telecommunications needs, an effort to compete on the basis of assurance. A recent advertisement in the *Wall Street Journal* touted the superior security of a particular form of cellular service. Articles in the trade press have emphasized the importance of companies' customer service.[1] The ability to innovate and adapt to changing conditions in the business environment is far superior in a market than under any kind of hierarchical control mechanism, whether imposed by industry or government. Industry

Even a cursory contemplation of the relative advantages and disadvantages of the control mechanisms leads to the conclusion that, compared to the other two, a market standard has impressive pluses. Determining when a market is sufficiently competitive so as no longer to need consumer protection standards is, of course, the key public policy question.

[1] "Making Service the Competitive Battlefield," *Global Telecoms Business* 10 (June/July 1995); "Customer Care Special," supplements to *Telephony* (Nov. 6, 1995); and Jerry L. Weikle, "Open Your Eyes to Wise Guys," *Rural Telecommunications* (September/October 1995): 43-46.

economic productivity should improve, as budgets are appropriately revised and market-based investment decisions made. Some of the service quality problems that regulated telecommunications companies have had may be due to inexperience with responding to the voice of the customer. As they gain familiarity with demand and marketing, companies may be better able to make business decisions that do not focus merely on cutting cost but on customer service as well.

Determining when a market is sufficiently competitive so as no longer to need consumer protection standards is, of course, the key public policy question. At a practical level, one test might be the number of consumer complaints about telecommunications services. If they dropped substantially, then a competitive telecommunications market might (absent other information) be assumed to exist. Developing and applying clear criteria to identify a competitive market will be essential to making correct public policy decisions that affect the quality as well as the price of telecommunications services. One such set of criteria has been developed by Edwin Rosenberg of the NRRI staff.[2] The Telecommunications Act of 1996 includes a competitive checklist to guide judgments on when local markets are competitive. The feasibility of market controls depends on how well the market has developed and an accurate assessment of the degree of competition by government agencies, whether they are the state commissions, the FCC, or the Department of Justice.

Where competition does not yet exist, administrative costs are likely to be higher if regulatory rather than industry controls are imposed on quality, while adaptability to change and the ability to foster innovation may be lower when government intervenes rather than industry regulating itself. Meeting consumer demand for quality is likely to fall short under either industry or regulatory controls. As suggested in chapter 5, the company with monopoly power will tend to

---

[2] Raymond W. Lawton, Edwin A. Rosenberg, Mary Marvel, and Nancy Zearfoss, *Measuring the Impact of Alternative Regulatory Pricing Reforms in Telecommunications* (Columbus: NRRI, 1994), 174.

undersupply quality when output and quality are demand substitutes, oversupply when they are complements and reduce basic service quality while introducing high-price service enhancements. Well-designed regulatory programs limit the ability of the monopolist to use these strategies, although experience shows that the result may be an oversupply of reliability and assurance but an undersupply of choice of services. Under monopoly conditions, improvements in industry performance are best achieved by coupling price regulation with quality of service incentives.

Ability to meet industry demand for quality (the fifth factor to be considered in our truncated approximation of a cost-benefit analysis) could not be fully accomplished even if there were perfect competition, insofar as the technical needs of establishing and maintaining an intermeshed network are concerned. The incentive to establish and comply with standards comes from the need of the owners of telecommunications networks to send and receive the traffic carried by other networks. They can be expected to aim for high reliability. Although we have strong reservations about the process of technical standard setting, that process is moving swiftly and inexorably. It would be neither feasible nor desirable for state regulatory commissions to actively intervene in the process of setting technical standards. Observation of the standard-setting process by government agencies representing the public would be desirable, however, because of the customer service implications of technical standards setting. In addition, the role of commissions as mediators or arbitrators, provided by the federal telecommunications reform legislation, makes sense where incumbent carriers attempt to leverage monopoly power to their advantage in setting and adhering to quality of service standards for interconnection. In other words, where interconnectors are the customers and one provider still has monopoly power, government oversight of the service quality provided to them is justified as it is for pricing issues like access charges.

Achievement of equity objectives, like universal service and the furthering of economic development, are the domain of government intervention rather than market or industry controls. The specter of a country divided into information haves and have-nots might well come to pass without some government oversight. Although opening markets to competition is likely to lead to greater productivity and worldwide competitiveness for U.S. companies, industry use of discount rates that emphasize short-run profits rather than long-term social goals can lead to economic growth that is uneven. The NII, if indeed that is a goal we want to achieve, may need a boost through government incentives, such as the special tariff rates for schools and libraries required under the new federal law. Thus, availability in the broad sense is not fully realized by firms aiming at maximizing individual economic welfare. Without government protections and sanctions, security, too, is unlikely to be guaranteed at the levels desired by consumers.

Achievement of equity objectives, like universal service and the furthering of economic development, are the domain of government intervention rather than market or industry controls.

Measurability of levels of quality achieved is the final factor to be considered in deciding which form of control is appropriate for assuring quality at levels that consumers want. Without the ability to assess quality we will not be able to see whether public policy objectives are being met. Nor will consumers be able to compare quality choices systematically. Whether market structure is competitive or affected with monopoly power, industry will have little reason to collect and publish statistics on quality and incumbent companies can use their brand names to hold onto customers. Nor are professional quality analysts likely to spring up in the private sector to help consumers evaluate quality offerings the way financial analysts help investors judge the value of financial instruments. Developing, applying, and publishing measures of quality in telecommunications is best accomplished by government. By having public measures, you encourage new

entrants because they can spend less capital on building a name and more on complying with the standards.

Summary of Recommendations

Table 7-1 provides a list of all our recommendations. The major recommendations made in this report require commissions, first of all, to recognize the differing quality aspects of competitive and monopoly conditions, and then to apply appropriate types and degrees of government oversight, whether through influence over industry controls, leveraging market controls, or direct protective or economic regulation.

Regulators must carefully distinguish between competitive and noncompetitive markets and services, and tailor their oversight of quality of service to market conditions.

Analysis of the economics of quality in telecommunications reaffirms the importance of moving as quickly as possible to viable competitive markets. Relaxation of regulatory entry barriers, as mandated under the federal telecommunications reform legislation, is probably the most effective tool policy makers can have to influence quality choice by industry. Many areas of the United States, however, are likely to remain the monopoly domain of incumbent local exchange carriers for the foreseeable future.

Perhaps the most important job of the regulator in promoting telecommunications quality during the transition to competition is the same as for encouraging correct pricing–making accurate judgments about what services are competitive. This requires not only assessing the degree to which the company faces competition but whether particular groups of services are competitive.

TABLE 7-1
RECOMMENDATIONS TO IMPROVE QUALITY OF SERVICE IN TELECOMMUNICATIONS

General:

- Accurately distinguish between competitive and noncompetitive services and companies
- Consider full range of service quality dimensions in designing policies, standards and programs
- Regional and national cooperative efforts to assure service quality

Monopoly Services:

- Examine a minimum subscribership plan

- Standards:
  - Consider new standards (for example, baud rates)
  - Define standards clearly
  - Do not accept industry standards without careful review
  - Make sure standards are measurable
  - Base standards on open, collaborative rule making processes
  - Consider using weighted indices of quality of service
  - Base standards on expectation of improved quality for basic service
  - Specify performance rather than design standards

- Monitoring:
  - Require regular company reports
  - Require an appropriate level of detail
  - Use format agreed on by industry and regulator
  - Conduct service quality audits
  - Use field investigations
  - Develop and analyze intrastate data
  - Expand ARMIS data

- Customer complaints:
  - Categorize by company and rule
  - Establish toll free numbers to file complaints
  - Send copies to commissions of all complaints received by company
  - Keep electronic records of all complaints

- Customer satisfaction:
  - Develop better measures
  - Find out how regulated companies are already measuring.

- Enforcement:
  - Use ability to assess fines and order rebates
  - Tie service quality into price cap formula or price regulation agreements
  - Make penalties automatic
  - Target penalties to compensate affected customers.

TABLE 7-1 (Cont.)

RECOMMENDATIONS TO IMPROVE QUALITY OF SERVICE IN TELECOMMUNICATIONS

Monopoly Services (Cont.)

- Resources:
  - Develop staff skills in public policy implementation and customer service
  - Consider combining customer service and technical staff functions
  - Separate telecommunications complaint handling from all-utility complaint handling function
  - Develop staff skills in handling interconnection quality of service issues

Monopoly and Competitive Services:

- Adopt a consumers' bill of rights
- Adopt consumer service standards to promote public values and in areas where a competitive market does not exist
- Use principles of adopting good standards listed above under monopoly services
- Do not apply standards of one industry to all industries
- Establish a data base of consumer education materials prepared by companies and commissions
- Publicize industry results
- Report relative performance across industries
- Label quality

Technical Industry Standards:

- Promote consumer input into the industry standard setting process
- Form user groups for telecommunications technologies
- Provide government leadership in development of the national information infrastructure
- State goals, values and performance standards for U.S. telecommunications policy
- Government subsidization of technical telecommunications research
- Participate through NARUC in industry forums
- Encourage the Network Reliability Council to expand its quality of service oversight

Source: Author's construct.

Regulators may want to explore the possibilities for participation in the industry standard-setting process.

When transactions costs are high or when there is a danger of big players using the standard-setting process to crowd out potential competitors, end users, including both commercial and residential customers, may be well served by government intervention. This is not a call for heavy-handed intrusion of government into private decision making. Further research is needed to identify transaction and institutional barriers to effective representation, and from that to a definition of the appropriate mix and responsibilities of government, the market, and voluntary technical standards. Guided by such analysis, government intervention can be used selectively to reduce transaction costs so that private parties can reach their own agreements. At a minimum, a representative of public service commissions could monitor the proceedings of standard-setting bodies. A reference model might be developed, similar to one now in use in Japan, that loosely states the goals and values of U.S. telecommunications policies and the performance standards that are needed if those goals are to be achieved. The model would not dictate the technologies to be adopted, a function of the market.

Major recommendations:

- *Carefully distinguish between competitive and noncompetitive markets*
- *Tailor oversight of quality to market conditions.*
- *Strengthen traditional protective regulation.*
- *Examine a minimum subscribership form of regulation*
- *Develop new means of informing the public*

Where markets and services remain monopolies, commissions will want to strengthen traditional protective regulation, particularly enforcement.

As price regulation continues to sweep the regulatory scene, regulators must continue what they already are doing–making sure to tie quality goals to price caps, so that companies cannot bypass minimum expectations for quality by captive customers. Embedding a quality of service factor in price cap formulas is one way

to do that. Simply including service quality requirements in price regulation agreements is another. Unified quality of service indices offer promise of providing sophisticated protective regulation, depending on conditions in a particular state. Regional cooperation offers opportunities to better oversee service quality in a widespread area, particularly given the possibility that local exchange carriers will merge and cover even wider territories than now. Better ways of assessing customer satisfaction will need to be developed, to ensure a customer-centered approach to protective regulation.

The key to effective protective regulation is credible enforcement, a serious problem for many commissions. A strong program of protective regulation, well staffed by experienced experts in customer service and the technical aspects of telephony, must underpin the ability to respond with price reductions, fines, customer refunds, and the other tools available to commissions to penalize regulated companies when they do not meet their quality of service obligations.

Where markets and services remain monopolies, commissions might examine a minimum subscribership form of regulation.

As regulation shifts from economic to protective controls, it is possible to envision a regulatory system based first and foremost on quality rather than price. Making telephone service available to all Americans (universal service), a quality goal, is a primary concern of social policy in telecommunications. Capping prices aids in preparing regulated companies for competition and promotes economic efficiency, while safeguards for quality must be built into the price regulation plans. Blank proposes a regulatory mechanism that would stand this process on its head, making the degree of availability the test that jurisdictional utilities must meet, rather than price ceilings. The MSP would impose a minimum constraint on the number of residential telephone subscribers that an essential telecommunications provider must serve. The result would be higher service quality than under price caps and encouragement of innovation. The efficiency promised by price caps

would not be lost under minimum subscribership regulation, since a firm operating under this form of regulation still would want to produce at least-cost levels.

Regulators can usefully develop new means of informing the public about the degree and type of telecommunications quality available.

Consumer access to clear, accurate, appropriate information is essential to the ability to exercise choices of both price and quality. Yet all three of the major controls on quality that we have examined are susceptible to failure to disseminate the information consumers need. Information absence, inadequacy, or asymmetry is a bugaboo of regulation and of the elusive ideal of perfect competition. The success of competition in meeting consumer demand for quality may well depend on making sure that customers know what they are buying and how it compares to other consumer benefit packages that are available. One of the strategies of telecommunications companies hoping to develop market share is to provide one-stop shopping from familiar companies, counting on consumers' preference for simplicity and assurance, not to mention inertia. To the extent that good information helps consumers to avoid rejecting new entrants solely because they are unknowns, programs providing consumer information serve to promote competition.

A first step in such an approach might be to develop and publicize a telecommunications consumer bill of rights, similar to the one now used by the Colorado PUC. The bill of rights could cover all of the major dimensions of service quality we have identified, as does Colorado's. Simply publicizing comparative results for providers of telecommunications services on a number of important dimensions would assist consumers in making decisions. The development of a grading system, like that used in nutritional labeling, would be a complex task. But such labeling could aid consumers to choose and warn them when no standards as yet existed and they were entering uncharted waters, offering neither full knowledge nor recourse to commission intervention.

POSTSCRIPT

Of the three general control mechanisms that govern quality of service, market solutions are, naturally, the preferred choice for goals that have to do with economic efficiency. In the absence of a market, however, regulatory controls are still necessary for consumer service standards and to mediate intra-industry conflict when interconnectors have difficulty meeting network quality needs. Nor is industry able to meet equity objectives, including redistribution of service availability from urban to rural, rich to poor, or intergenerationally, as national goals for availability of the information infrastructure and economic development might dictate. Finally, government has a role in measuring and reporting on quality where industry does not, in order to make up for deficiencies in information flows whether or not the market is competitive.

As we move towards an era of a network of networks in telecommunications, a new emphasis on protective regulation is needed to assure Americans of the quality they want.

State regulatory commissions have over a century of experience in economic regulation, assuring a fair rate-of-return on the fair value of their investment for stockholders and affordable rates for customers. Protective regulation, the *raison d'être* for many well-established government agencies, has lived in the shadow of traditional economic regulation. As we move towards an era of a network of networks in telecommunications, a new emphasis on protective regulation is needed to assure Americans of the quality they want. We have suggested approaches to doing so which may well require not only a reprioritization of regulatory goals but new programs and reallocation of resources.

APPENDIX A

NRRI SURVEY ON TELECOMMUNICATIONS QUALITY OF SERVICE STANDARDS IN SELECTED STATES

April 1995

NRRI SURVEY OF TELECOMMUNICATIONS QUALITY OF SERVICE STANDARDS IN SELECTED STATES

State:_____
Date:_____
Staff respondent:_____
Title:_____
Phone:_____
Fax:_____

The National Regulatory Research Institute (NRRI) is beginning a NARUC-sponsored research project on changes in state policies on telecommunications service quality. As part of this research we are asking for in-depth information on quality of service standards from your state and others that have changed their standards since the AT&T divestiture.

This survey is being faxed to you for you to read and then go through over the telephone with researchers Nancy Zearfoss (614) 292-5434 or Vivian Witkind Davis (614) 292-9423, who will schedule an appointment to call you. We expect to have all surveys complete by the end of April and complete the final research report this summer. Thank you in advance for your help.

Origins of standards

1. When were quality of service standards first instituted? Year_____
   Commission Order No._____

2. When were current or <u>new</u> standards instituted? Year_____
   Commission Order No._____

3. Why were new standards instituted?
   _____Potential for service deterioration _____Changing technology
   _____Change of reporting requirements instituted by Commission
   _____Complaints from companies about reporting requirements
   _____Change in utility regulation _____Other

4. What type of regulation is currently used in your state for each of the following types of companies and when was it instituted?

Type of Reg	BOCs	Year	nonBOCs	Year	Other	Year
Traditional						
Rev/Profit Share						
Basic/nonbasic						
Flexible pricing						
Price caps						

5. What connection, if any, is there between the establishment of new standards and alternative regulation? Is there any documentation of this connection?

_____

_____

6. Who was responsible for promoting new standards?
   _____Commission Staff _____Commissioners
   _____Regulated companies _____Consumers' groups
   _____Competitors of regulated companies
   _____Other:_____

7. Were any particular examples of quality of service standards from other states considered applicable to yours? Were any of help in designing your standards? (If other state examples, please name the state(s) and what aspect of their standards was useful).

_____

_____

Applicability of standards

8. Does your regulatory agency have formal telephone service quality standards for the following:

BOCs	nonBOCs	IXCs	COCOTs	STS	AOS	Hospitality Industry	Other

9. What types of services are subject to the new quality of service standards?
   _____All _____Only noncompetitive or basic services
   _____Other_____

10. Do the quality of service standards for the local exchange company apply to all customer groups? Please check the customer groups below to which these standards apply.
    _____Residential _____Interexchange carriers
    _____Small business _____Cellular
    _____Large business _____Shared tenant services
    _____Competitive access providers
    _____Customer-owned, coin-operated telephones
    _____Resellers
    _____Enhanced service providers Other:_____

11. Are there service quality standards included in tariff terms and conditions which are not included in the formal quality of service standards? _____No
    _____Yes: What are these standards and to what services do they apply?

Type, scope and measurement of quality of service

12. Indicate whether there are currently specific standards for the following services. If there are, do they differ from the former standards and if they do, why? (For example, does the new standard have greater scope, require more or less reporting, have more stringent penalties attached, or set different levels or ranges to meet?)

Type of standard	Standard? (yes or no)	Difference from old standards?	Explanation
Installation	_____	_____	_____
Repair	_____	_____	_____
Transmission	_____	_____	_____
Directory assistance	_____	_____	_____
Operator assisted calls	_____	_____	_____
Billing and collections	_____	_____	_____
Service cutoff	_____	_____	_____
911 data base	_____	_____	_____
Access to toll service	_____	_____	_____
Non-LEC provider access	_____	_____	_____
Customer satisfaction	_____	_____	_____
Coin-operated service	_____	_____	_____
Intercept service	_____	_____	_____
Foreign exchange service	_____	_____	_____
Customer appointments	_____	_____	_____
Hearing/speech impaired	_____	_____	_____
Other	_____	_____	_____

13. Are the standards weighted or combined in any special way?
_____No _____Yes:
If yes, please provide a copy of the index or formula used.

14. Has the commission established standards the company is not currently meeting? (This could include engineering standards. For example, the commission might have ordered that within some time frame, all central office switches will be digital or all lines will have access to ISDN.)

_____No _____Yes: Are these included in the current quality of service standards? _____No _____Yes

15. Which standards do BOCs have trouble meeting? Why?

16. Which standards do independents and small companies have trouble meeting? Why?

Commission role in monitoring

17. How is quality of service monitored?
__Company reports
__Commission monitoring of customer complaints
__Commission monitoring through field investigations
__Other:_____

18. Indicate whether periodic reports are required for LECs (L) or IXCs (I).

Reports required?	Quar-terly	Month-ly	Annual-ly	By ex-change	By test center	By C.O.	By Total Co	On Surv'Ince Basic

19. How many Commission staff are assigned, both full-time and part-time, to the following:

Telephone Complaint handling	FT_____	PT_____
Telephone Service Evaluation	FT_____	PT_____
Telephone Inquiries	FT_____	PT_____

20. What is the annual Commission budget for telecommunications quality of service?

    $_____

21. How many inquiries did the Commission receive in 1994?_____
    How many were complaints?_____
    What is the distinction between inquiries and complaints?_____

Enforcement of standards

22. What actions can occur when proper corrective action is not taken for deficiencies cited in evaluation reports?

Fine/reparation	Show Cause	Rate Case Penalty	Other	N/A

23. Can a company be rewarded as well as penalized for quality of service?
    _____Yes _____No

24. What is the relationship of meeting quality of service standards to the alternative regulation plan? (For example, is the continuation or extension of the plan dependent upon the company meeting minimum standards? Are standards tied to a price cap formula?)

25. Has a company been penalized for poor quality of service under the new quality of service standards? _____ No _____Yes
    rewarded for good service quality _____ No _____Yes

26. Have there been or do you foresee any problems with the enforceability of the quality of service standards?

27. Has the company been asked to take action such as creating a plan to upgrade quality of service that is below commission standards? _____ No
_____ Yes: If yes, is this plan being monitored by the Commission?
_____ No _____ Yes

28. What, if any, service quality problems does the Commission require the company to take care of immediately?

Evaluation of standards

29. How is a company's conformance with quality of service standards evaluated?

During rate case	Review of regulatory structure	Annually	Every two to three years	Randomly	Follow-up to complaints\ Commission order	N/A

30. Can certain circumstances trigger an evaluation? _____ No _____ Yes: If yes, what circumstances?

31. Is another revision of service quality standards taking place currently or scheduled within the next year? _____ No _____ Yes: When_____

32. Overall, how well do you feel the commission's quality of service standards are working?

_____

_____

33. What problems or opportunities do you see for your commission's quality of service standards? _____

34. Does the Commission have a specific goal for level of availability for basic local telephone service? _____ No _____ Yes: Standard: _____

35. If No to 34, has the Commission considered setting standards for availability?

36. How do you know if a market is competitive?

37. Is this a Commission standard?
_____ No _____ Yes

38. Does the Commission have a method for measuring level of innovation or diversity of products being ordered by the BOC or large independent?

Thank you for your help!

APPENDIX B

COMMISSION STAFF RESPONDENTS TO 1995 NRRI SURVEY

COMMISSION STAFF RESPONDENTS TO 1995 NRRI SURVEY		
Commission	**Contact**	**Telephone**
Alabama Public Service Commission	Darrell A. Baker Engineering Specialist	(334) 242-5025
Arizona Corporation Commission	Del Smith Utilities Consultant (Telecommunications Enginner) Robert Kennedy Consumer Services Program Manager	(602) 542-7277 (602) 542-0840
Arkansas Public Service Commission	Brinton Ramoly Senior Telecommunications Engineer	(501) 682-5797
California Public Utilities Commission	Daljit Singh Senior Utilities Engineer Betty Brandel Consumer Affairs	(415) 703-1801 (415) 703-1850
Colorado Public Utilities Commission	Warren Wendling Supervising Professional Engineer Barb Fernandez Consumer Complaints	(303) 894-2000 ext. 377
Connecticut Department of Public Utility Control	Quat Nguyen Telecommunications Engineer Barnie Spector Consumer Service Unit	(203) 827-2696 (203) 827-2660

COMMISSION STAFF RESPONDENTS TO 1995 NRRI SURVEY (Cont.)		
Commission	**Contact**	**Telephone**
Delaware Public Service Commission	Don Coates* Chief of Finance and Accounting Melinda Carl Public Information Officer	(302) 739-3226 (302) 739-4333
District of Columbia Public Service Commission	Robert Loube Director of the Office of Economics	(202) 626-9197
Florida Public Service Commission	Alan Taylor Chief of Bureau of Service Evaluation	(904) 488-1280
Idaho Public Utilities Commission	Joe Cusick Telecommunications Analyst Beverly Barker Supervisor, Consumer Division	(208) 334-0333 (208) 334-0302
Illinois Commerce Commission	Harvey Nelson Economic Analyst Mike Gibson Program Director, Consumer Affairs	(217) 524-5067 (217) 782-2024
Iowa Utilities Board	Phyllis Finn Senior Utilities Analyst	(515) 281-6814
Kansas Corporation Commission	Dow Low* Director of Utilities Division	(913) 271-3199

* No longer with the Commission.

COMMISSION STAFF RESPONDENTS TO 1995 NRRI SURVEY (Cont.)		
Commission	**Contact**	**Telephone**
Massachusetts Department of Public Utilities	Jordan Michael Telecommunications Analyst Joslyn Day Consumer Affairs Division	(617) 727-8627 (617) 727-7731
Michigan Public Service Commission	Howard Bradshaw Communications Engineer	(517) 334-7153
Montana Public Service Commission	Mike Sheard Rate Analyst Kate Whitney Consumer Representative	(406) 444-6189
Nebraska Public Service Commission	Gene Hand Director of Communications Department John Burvainis Accountant	(402) 471-0244
Nevada Public Service Commission	Jeff Galloway Telecommunications Specialist	(702) 687-6036
New Hampshire Public Utilities Commission	Mary Coleman Utility Analyst, Economics Department	(603) 271-2431
New Jersey Board of Public Utilities	Frank Chappa Supervising Engineer	(201) 648-2295

COMMISSION STAFF RESPONDENTS TO 1995 NRRI SURVEY (Cont.)		
Commission	**Contact**	**Telephone**
New Mexico State Corporation Commission	Ken Solomon Director of Telecommunications Department	(505) 827-4495
New York Public Service Commission	Ruvain Kudan Associate System Planner Gene Connell Consumer Complaints	(518) 474-3138 (518) 474-0999
Public Utilities Commission of Ohio	Rick Reese Telecommunications Specialist	(614) 466-0793
Oregon Public Utility Commission	Woody Birko Senior Utility Engineering Analyst	(503) 378-6122
Pennsylvania Public Utility Commission	Louis Sauers Consumer Research Analyst/Supervisor	(717) 783-6688
Rhode Island Public Utilities Commission	James Lanni Associate Administrator of Operations	(401) 277-3500 ext. 120
Tennessee Public Service Commission	Eddie Roberson Director of Consumer Services	(615) 741-0173
Texas Public Utility Commission	Rowland Curry Chief Engineer, Office of Policy Development Kathy North Manager of Consumer Affairs	(512) 458-0100 (512) 458-0300

COMMISSION STAFF RESPONDENTS TO 1995 NRRI SURVEY (Cont.)		
Commission	**Contact**	**Telephone**
Virginia State Corporation Commission	Alan Wickham Manager of Operations, Communications Edward M. Bishop Senior Telecommunications Specialist	(804) 371-9674 (804) 371-9608
Vermont Public Service Board	Riley Allen Utilities Analyst	(802) 828-2358
Vermont Department of Public Service	Charlie Larkin Telecommunications Engineer	(802) 828-4008
Wisconsin Public Service Commission	Chris Johnson Staff Engineer Mary Pat Lytle Assistant Administrator, Division of Water, Compliance and Consumer Affairs	(608) 266-1613 (608) 267-9491
Wyoming Public Service Commission	David Walker Supervising Rate Engineer	(307) 777-5747

APPENDIX C

FURTHER INFORMATION ON CURRENT COMMISSION QUALITY OF SERVICE PROGRAMS

This appendix supplements the information discussed in chapter 3. It adds details on commission service quality standards and monitoring programs, using results from the NRRI survey of selected states conducted in the summer of 1995.

This Appendix supplements chapter 3, which discussed commission initiatives in quality of service programs. Here we will provide background information supporting that chapter's analysis of service quality standards and monitoring programs, using further results from the NRRI's 1995 survey of selected states. That survey in turn built on findings reported in NARUC's *Telephone Service Quality Handbook.*[1] The *Handbook* identified performance standards and analysis, customer complaint analysis, field testing, and customer surveys as tools a commission can use to assure telecommunications service quality.

Types of Service Quality Standards

NARUC first adopted model telecommunications service rules in 1977 and updated them in 1987. NARUC's model rules include technical standards for service expected under normal operating conditions for installation of service, operator handled calls, network call completions, transmission and noise, and customer trouble reports. State regulatory commissions are not required to adopt these rules, but many have used them as templates for the development of their own standards.

Table C-1 details services for which staff respondents reported that standards exist in their states. The NARUC *Handbook* strongly supports the establishment of service quality standards and analysis of performance against them: "Without standards, performance measurements are meaningless," state the authors. "Without performance measurement and analysis, standards are useless."[2]

---

[1] National Association of Regulatory Utility Commissioners, *Telephone Service Quality Handbook* (Washington, D.C.: NARUC, 1992).

[2] Ibid., 8.

TABLE C-1
SERVICES FOR WHICH SELECTED STATES HAVE STANDARDS
(as of July 1995)

Services	Commissions
Installation	AL, AR, AZ, CA, CO, CT, DE, DC, FL, IL, IA, MA, MI, MT, NV, NH, NJ, NM, NY, OH, PA, RI, TN, TX, VA, WI, WY
Repair	AL, AR, AZ, CA, CO, CT, DE, DC, FL, ID, IL, IA, KS,[a] MA, MI, MT, NE, NV, NH, NJ, NM, NY, OH, PA, RI, TN, TX, VA, WI, WY
Transmission	AL, AR, AZ, CO, DE, DC, FL, IL, IA, MA, MI, MT, NE, NV, NH, NJ, NY, OH, OR, PA, TX, WI
Directory Assistance	AL, AR, AZ, CA, CO, CT, DE, DC, FL, IL, IA, MA, MI, MT, NE, NV, NH, NJ, NY, OH, OR, PA, RI, TN, TX, VT,[a] WI
Operator Assisted Calls	AL, AR, AZ, CA, CO, DE, DC, FL, IL, IA, MA, MT, NE, NH, NJ, NY, OH, OR, PA, RI, TX, WI
Billing and collections	AL, AR, AZ, CO, CT,[a] DE, DC, FL, IL, IA, KS, MI, MT, NE, NH,[a] NM, OH, PA, RI, TX, VT,[a] WI
Service cutoff	AR, AZ, CA,[a] CO, CT,[a] DE, DC, FL, IL, IA, KS, MI, MT, NE, NH,[a] NJ, NY, OH, OR, PA, RI, TN, TX, VT,[a] WI, WY
911 data base	AZ,[a] CO, CT, DE, FL, IL, MI, NJ, PA, WI
Access to toll service	AR, AZ,[a] CA,[a] CO, CT,[a] DE, DC, FL, IL, IA, NE, NH, NJ, NY, OH, PA, WI
Non-LEC provider access	AR, AZ,[a] CA,[a] DE, FL, IL, PA, WI
Customer satisfaction	AZ, CA, CO, DE, DC,[a] FL, MA, MT, NE, NV, NH, NJ, PA, RI, VA
Coin-operated service	AL, AR, AZ,[a] CA, CO, CT,[a] DC, FL, IL, MI, MT, NE, NJ, NY, OH, OR, PA, RI, TN, TX, VA, VT,[a] WI,[a] WY

[a] Standards exist but are only included in terms and conditions of tariffs.

TABLE C-1 (Cont.)
SERVICES FOR WHICH SELECTED STATES HAVE STANDARDS
(as of July 1995)

Services	Commissions
Intercept service	AR, AZ, CA,[a] CO, DC,[a] FL, IL, IA, MI, MT, NE, NY, OH, PA, TX, WI[a]
Foreign exchange service	AZ,[a] CA, CO, CT,[a] DC,[a] IL, IA, MI,[a] OH, PA, WI,[a] WY[a]
Customer appointments	AR, AZ, CA, CO, CT, DE, DC, FL, IL, MA, MI, MT, NV, NH, NJ, NY, OH, PA, RI, TN, TX, VA, WI[a]
Hearing/speech impaired[b]	AL, CA, CO, CT,[a] DC, FL, IL, MT, NE, NJ, NY, PA, RI, TN, TX, VA, WY
Access to business/repair office	AR, AZ, CA, CO, CT, DE, DC, FL, IL, IA, MA, MI, NE, NJ, NY, OH, PA, RI, VA

[a] Standards exist but are only included in terms and conditions of tariffs.
[b] FCC has imposed standards.

Source: NRRI Survey of Selected States, summer 1995.

Services for which the largest number of commissions have specific, written standards are repair (30), installation and directory assistance (27), and service cutoff (26). (See Table C-1.) More than 60 percent of the 32 commissions have standards covering pay telephone service (24), customer appointments (23), transmission, operator assisted calls, and billing and collections (22), and access to live personnel in the company's business and repair offices (19). Two services for which standards exist somewhat independently of state commissions are transmission, generated by the industry, and standards for the hearing and speech impaired, generated and imposed by the FCC. Since companies already subscribe to a set of standards for these services, some commissions have deemed it unnecessary to create additional ones.

Not all states have formal quality of service standards. In some states, standards are contained in the terms and conditions of posted tariffs. The difference is not one of enforceability, since the company will be legally bound in either case. Rather, it is one of generalizability and control. When standards are codified, they apply equally to all companies providing the covered service. When standards are included in terms and conditions of tariffs, they apply only to the company whose tariff contains the terms and conditions. The company can change the terms and conditions in the tariffs unless there is a commission ruling forbidding such action without commission approval. A state which has service standards exclusively in tariff terms and conditions may not have had problems with that service. Conversations with staff respondents indicated that in many states, formal standards primarily come into being to rectify a problem. In our survey of 32 utility commissions, 22 reported having standards for some services in the tariff terms and conditions which are not included in the formal service quality standards (Table C-2). The service most often cited as having standards exclusively in terms and conditions is customer-owned pay telephones (ten states), followed by high-speed data transmission (five states), and billing and collections and service cut-off (five states each). Definitions for the listed services, as well as examples and performance measurements, are provided below.

INSTALLATION

Services covered by these standards are the installation of primary service both when there are and are not existing plant facilities, the speed with which the installation is made, the appointments with customers kept by the company, and sometimes the installation of service other than primary or initial connection.

TABLE C-2 INCLUSION OF SERVICE QUALITY STANDARDS IN TARIFF TERMS AND CONDITIONS (as of July 1995)	
Commissions with Additional Standards in Tariffs	**Commissions without Additional Standards in Tariffs**
AL, AZ, CA, CT, DE, DC, FL, IL, KS, MI, NH, NM, NY, OH, OR, PA, RI, TN, TX, VT, WI, WY	AR, CO, ID, IA, MA, MT, NE, NV, NJ, VA

Source: NRRI Survey of Selected States, summer 1995.

The NARUC *Handbook says:*

> "This measurement evaluates the adequacy of a utility's telephone plant facilities as well as available workforce to install telephone service to its customers...The focus is on adequacy of both inside and outside telephone utility plant facilities and the availability of adequate workforce."[3]

The NARUC model rules recommend three measures for installation of service: percent primary orders completed within three working days, the percent of all service orders filled within 30 days, and the percent of commitments met.

Florida rules cover primary service only and require the company to have 90 percent of primary service installation requests met within three days and to keep 90 percent of appointments made. Colorado requires local exchange carriers to provide primary service within five working days of application when facilities are available and within 90 days of application when facilities are not available.

---

[3] Ibid., 10.

REPAIR

Repair of telephone service usually refers to problems in making and receiving calls. In many states this is also referred to as "customer trouble reports." Many commissions have established standards for the number of trouble reports per 100 lines which a company can receive before it is out of compliance. In response, companies have a list of reasons for which a customer trouble report may be excluded from the tally of trouble reports per 100 lines. Measurements usually refer to the percent of out-of-service lines cleared within 24 hours and the percent of repair appointments kept. Pennsylvania and Georgia require companies to clear 100 percent of out-of-service lines within 24 hours, Florida requires 80 percent repaired on the same day as reported, Rhode Island requires 60 percent cleared within 24 hours while the majority of states follow the NARUC model of 90 percent cleared within 24 hours. Tennessee has standards for repair of special services and switched access, not just repair of primary service.

TRANSMISSION

Rather than specifying detailed technical standards, many states may have rules requiring that company-constructed facilities meet "nationally accepted or state approved design and construction standards."[4] Those states which have implemented specific standards have usually taken them from existing national industry standards. The *Handbook* explains, "Many of the regulatory transmission and noise standards for telephone utilities are derived from the *BOC Notes on the LEC Network - 1990* published by Bellcore, or its preceding versions."[5] Despite widely accepted industry standards, states do vary in both types of standards and measurement of performance. For example, Kansas has no transmission standards

---

[4] Ibid., 13.

[5] Ibid.

while Florida has specific requirements for transmission noise and sound degradation.

Transmission standards may also measure and evaluate "the adequacy of central office equipment and interoffice channel capacity, and the ability of this equipment to complete a customer-dialed call over the local and intraLATA toll networks without the caller encountering equipment malfunction or an all-paths-busy condition."[6]

Directory Assistance

Standards for directory assistance may specify the speed with which the call is answered by a live operator, the attitude and manner of the operator to the customer, the information the operator should have available and sometimes the charge for directory assistance calls. Performance is measured in percent of calls answered within a specified length of time. Florida also measures the billing accuracy for directory assistance calls.

Operator Assisted Calls

This category can cover one or several types of calls which utilize the services of a live operator. Standards are likely to specify the time in which the operator must respond to the customer, the treatment of the customer by the operator, and the information which the operator must provide the customer if asked.

Billing and Collections

Standards for billing and collection include specification of the type of material which must appear on the bill, conditions for backbilling, and conditions under which a company can demand immediate payment.

---

[6] Ibid., 12.

Service Cutoff

Standards for service cutoff describe the charges for which the company can legally turn off service, depending on their delinquency. Standards for reconnection may also be included under service cutoff. The conditions under which service can be discontinued for nonpayment of long distance charges have been decided in a number of different ways across the states. For example, Kansas allows disconnection for nonpayment of incurred charges. The District of Columbia allows customers with unpaid long distance charges to get blocking of long distance service and take up to 24 months to pay the bill.

911 Data Base

Standards may cover how the service is to be financed, equipment, personnel, locus of responsibility for delivering the information to the company keeping the data base, and the time allowed for the information to be entered into the data base.

Access to Toll Service

Standards ordinarily apply specifically to resellers and govern the access of customers to their long distance carrier of choice.

Access by Providers Other Than Local Exchange Carriers

Standards govern the quality and type of connection from competitive access providers and interexchange carriers to the local exchange carrier.

Customer Satisfaction

Companies are often required to demonstrate the level of customer satisfaction with their service over some period of time and surveys are an accepted method for doing this. Standards may cover the types of questions on

the survey, the party responsible for conducting the survey, the customer groups to be surveyed, and timeframes for conducting and completing surveys.

Coin-Operated Service

These standards may cover both coin and credit card telephones. Standards often specify the number of pay phones the local exchange carrier must place within a geographic area, the maintenance of those phones, and the amount which can be charged for a local call.

Intercept Service

This is a service which the company provides for a line that is currently not in service, either because of customer choice, perhaps because of vacation or a move, or for nonpayment and subsequent disconnection. Standards define how long the number rings before the intercept service is activated and how long the service is to be in place.

Foreign Exchange Service

This is a service in which a caller dials a local number and pays for a local call but the call is a long distance call, either intra- or interLATA and is answered in a different local exchange.

Customer Appointments

In many states, when companies make appointments to install or repair service, they are now required to keep a record of appointments missed and why. Standards usually specify the number of appointments which the company must keep and some states impose financial penalties by requiring the company to offer the customer some form of rebate for missed appointments.

Hearing/Speech Impaired

The FCC has instituted standards governing the provision of the relay service for the hearing impaired. Most states simply follow these standards. Some states have made these standards stricter by requiring typists to type faster than required by the federal standards or requiring the company to provide more operators.

Access to Business and Repair Offices

The use of automated answering systems has sometimes left customers waiting for periods of minutes before accessing a live operator. Several states now have standards for the time a company can take to answer an incoming call by a live operator.

Time Intervals and Units of Observation in Company Reports

In the NRRI sample, the time period for local exchange company reporting most often used by commissions is monthly (16 commissions; see Table C-3). Three of these also require reports from LECs quarterly as do nine other commissions, bringing to 12 the total of those requiring LEC quarterly reports. Eleven commission require annual reports, of which two also require semi-annual reports. Three require quarterly reports and five require monthly reports. Three states–Montana, Michigan and Wisconsin–require no reports from LECs but do require the regulated companies to maintain records, which the commission can then request. Few commissions monitor the interexchange carriers and only five commissions require interexchange carriers to file reports. Four of those require annual reports and one (California) requires interexchange carriers to file quarterly reports.

The units of observation most widely used in company reports are local exchange or central office, used by 24 commissions, and total company, used by

18 (Table C-3). Because some exchanges are more prone to trouble than others because of weather, terrain or equipment, staff respondents remarked that companies would often prefer to report problems in terms of total company within the state rather than by exchange.

Steps to Include in a Field Testing Program

The NARUC *Handbook* makes clear that establishing a field testing program requires a significant investment of staff time to organize and carry out:

> Many things must be considered to establish a field testing program: What equipment is necessary? How is it to be used? What disposition will be made of the charges for access lines and toll used during testing? What coordination with industry is necessary? What industry source documents are available? What sample size is sufficient? How should results be reported? Should interexchange carriers also be evaluated? Should LEC and non-LEC pay phones be evaluated?[7]

The *Handbook* suggests a number of steps which should be taken in order to have a good field testing program:

1. Since specific equipment is needed to conduct the various tests, determination of what is to be tested must be made at the beginning.

2. Have telephone utility personnel on hand to observe staff testing unless they perform the tests themselves. This requires contacting the utility prior to testing to set up an appointment, but the timing is important: Too much advance time will result in extraordinary maintenance and too little time may result in not having access to the necessary personnel for testing or in general confusion.

---

[7] Ibid., 21.

TABLE C-3

TIME INTERVALS AND UNIT OF OBSERVATION
STATE COMMISSIONS REQUIRE IN SERVICE
QUALITY REPORTS BY LOCAL EXCHANGE CARRIERS
(as of July 1995)

Commission	Reporting Intervals	Unit of Observation
Alabama	Monthly	Central office
Arizona	Quarterly	I.N.A.
Arkansas	Semi-annually, on surveillance basis	Exchange
California	Quarterly, monthly	Exchange, test center, central office
Colorado	Monthly, quarterly, annually, on surveillance basis	Exchange, central office, total company
Connecticut	Semi-annually, annually	Central office, total company
Delaware	Monthly	Exchange
District of Columbia	Quarterly	Total company
Florida	Quarterly	Exchange
Idaho	Annually	Total company
Illinois	Monthly	By LATAs
Iowa	Monthly, annually	Central office, total company
Kansas	Monthly	Exchange
Massachusetts	Monthly, annually	Test center, total company
Michigan	On staff request	On staff request
Montana	On staff request	On staff request
Nebraska	Annually	I.N.A.
Nevada	Quarterly, annually	Total company
New Hampshire	Monthly	Exchange, test center, central office

TABLE C-3 (Cont.)

TIME INTERVALS AND UNIT OF OBSERVATION
STATE COMMISSIONS REQUIRE IN SERVICE
QUALITY REPORTS BY LOCAL EXCHANGE CARRIERS
(as of July 1995)

Commission	Reporting Intervals	Unit of Observation
New Jersey	Quarterly	Company management area
New Mexico	Monthly, quarterly, annually	Exchange, central office, total company
New York	Monthly	Exchange, central office, total company
Ohio	Monthly	Exchange, total company
Oregon	Monthly, quarterly, on surveillance basis	Exchange, central office, total company
Pennsylvania	Annually	Total company
Rhode Island	Monthly, on surveillance basis	Central office
Tennessee	Quarterly, on surveillance basis	Central office, total company
Texas	Monthly, on surveillance basis	Total company
Vermont	Monthly, annually	Exchange, central office, total company
Virginia	Monthly,	Central office, total company
Wisconsin	Only on request	Only on request
Wyoming	Quarterly	Exchange, total company

I.N.A. = Information not available

Source: NRRI Survey of Selected States, summer 1995.

3. In order to properly measure the level of service provided for certain categories, the investigator must ascertain access to recent company documents. "For example, recently completed service orders can be used to check the adequacy of new numbers in the directory and the adequacy of intercept service for changed and disconnected numbers."[8]

DISTINGUISHING COMPLAINTS FROM INQUIRIES

Customer complaints and inquiries are monitored and evaluated by all the commissions in the NRRI survey but there are significant differences in methods (Table C-4). Some states do not track inquiries. Some states do not differentiate between inquiries and complaints. One state does not keep an official tally of inquiries or complaints. In the matter of complaint definition, some states define a complaint on the basis of staff time required to resolve it, regardless of its content. Several states define complaints as inquiries which require contact with the company. Florida and Kansas define a complaint as a violation of a rule or tariff on the part of the company. And in Iowa and Texas, only written communications with the Commission are defined as complaints. In most states, complaints are a subset of inquiries, and an inquiry only becomes a complaint under specified conditions. Table C-5 shows numbers of inquiries and complaints. Adding inquiries and complaints provides the total number of inquiries which would subsume complaints.

Many calls received by commissions which are labeled inquiries may be considered complaints by the customer. This may be because a customer calls to complain about service received even though the matter has been resolved. Under most categorization schemes, this call would be labeled an inquiry.

---

[8] Ibid.

TABLE C-4

HOW COMMISSIONS DISTINGUISH BETWEEN TELECOMMUNICATIONS CUSTOMERS' INQUIRIES AND COMPLAINTS (as of July 1995)

Distinction	Commissions
An inquiry requests information; a complaint results when a customer has called the company, is not satisfied with the outcome and calls the commission.	AR, CT, RI
Complaints are inquiries which require contacting the company.	CO, DC, ID, MA, MI, NJ, NY
A complaint is filed if the company has violated a tariff or rule.	FL, KS
A complaint is an inquiry that requires further investigation.	AL, DE, OR, VT, WI,
A complaint is written and filed by the end-user with the Board.	IA, TX
An inquiry requires contact with the utility, often about billing; a complaint requires mediation between the company and customer.	MT
Do not make separate tallies of complaints and inquiries.	AZ, CA, NH, OH
Only track complaints and/or inquiries which require excessive staff time.	IL, NE, NV, NM, PA, TN, WI, WY
Do not keep a tally of inquiries or complaints.	RI

Source: NRRI Survey of Selected States, summer 1995.

TABLE C-5
INQUIRIES AND COMPLAINTS FOR MOST RECENT YEAR AVAILABLE
(as of July 1995)

Commission	Inquiries	Complaints	Totals
Alabama	1,690	2,016	3,706
Arkansas	16,575[a]	673	17,248
Arizona	I.N.A.	I.N.A.	2,650
California	I.N.A.	I.N.A.	26,005
Colorado	1,835	3,364	5,199
Connecticut	1,765	836	2,686
Delaware	I.N.A.	I.N.A.	I.N.A.
District of Columbia	49	387	436
Florida	45,819	6,902	52,721
Idaho	533	1,127	1,660
Illinois	Not tracked	6,000	I.N.A.
Iowa	1,372	281	1,653
Kansas	659	731	1,390
Massachusetts	18,400	2,065	20,465
Michigan	4,592	1,077	5,669
Montana	33[b]	536	569
Nebraska	Not tracked	400	I.N.A.
Nevada	Not tracked	754	I.N.A.
New Hampshire	I.N.A.	I.N.A.	4,503
New Jersey	1,500	2,485	3,985

I.N.A. = Information not available.

[a] Inquiries about all utilities.

[b] Do not keep track of inquiries that require no contact with the utility.

TABLE C-5 (Cont.)

INQUIRIES AND COMPLAINTS FOR
MOST RECENT YEAR AVAILABLE
(as of July 1995)

Commission	Inquiries	Complaints	Totals
New Mexico	Not tracked	900	I.N.A.
New York	4,985	13,267	18,252
Ohio	Not tracked	Not tracked	21,456
Oregon	2,119	1,989	4,108
Pennsylvania	Not tracked	4,255	I.N.A.
Rhode Island	Not tracked	Not tracked	I.N.A.
Tennessee	Not tracked	1,949	I.N.A.
Texas	1,276	2,156	3,432
Virginia	1,301	1,231	2,532
Vermont	3,919	1,212	5,131
Wisconsin	Not tracked	1,588	I.N.A.
Wyoming	Not tracked	586	I.N.A.

I.N.A. = Information not available.

Source: NRRI Survey of Selected States, summer 1995.

APPENDIX D

ABBREVIATIONS OF STATE NAMES

State	Abbreviation	State	Abbreviation
Alabama	AL	Montana	MT
Alaska	AK	Nebraska	NE
Arizona	AZ	Nevada	NV
Arkansas	AR	New Hampshire	NH
California	CA	New Jersey	NJ
Colorado	CO	New Mexico	NM
Connecticut	CT	New York	NY
Delaware	DE	North Carolina	NC
District of Columbus	DC	North Dakota	ND
Florida	FL	Ohio	OH
Georgia	GA	Oklahoma	OK
Hawaii	HI	Oregon	OR
Idaho	ID	Pennsylvania	PA
Illinois	IL	Rhode Island	RI
Indiana	IN	South Carolina	SC
Iowa	IA	South Dakota	SD
Kansas	KS	Tennessee	TN
Kentucky	KY	Texas	TX
Louisiana	LA	Utah	UT
Maine	ME	Vermont	VT
Maryland	MD	Virginia	VA
Massachusetts	MA	Washington	WA
Michigan	MI	West Virginia	WV
Minnesota	MN	Wisconsin	WI
Mississippi	MS	Wyoming	WY
Missouri	MO		

BIBLIOGRAPHY

Akerloff, George A. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." *Quarterly Journal of Economics* 84 (1970): 488-500.

Albery, Brooks. "What Level of Dialtone Penetration Constitutes 'Universal Service'?" *Proceedings of the Ninth Biennial Regulatory Information Conference.* Columbus, OH: The National Regulatory Research Institute, 1994.

Alliance for Telecommunications Industry Solutions. *Network Reliability Steering Council Annual Report*. Washington, D.C.: ATIS, 1995.

_____. *ATIS 1995 Annual Report*. Washington, D.C.: ATIS, 1995.

_____. *ATIS 1994 Annual Report*. Washington, D.C.: ATIS, 1994.

"Ameritech-Ohio Settles Service Complaint Probe." *State Telephone Regulation Report* 13, no. 20 (Oct. 5, 1995): 13-14.

Armstrong, Mark, Simon Cowan, and John Vickers. *Regulatory Reform: Economic Analysis and the British Experience*. Cambridge, MA: MIT Press, 1994.

Baumol, William and Al Klevorick. "Input Choices and Rate-of-Return Regulation: An Overview of the Discussion." *Bell Journal of Economics and Management Science* 1 (1970): 162-190.

Beath, John and Yannis Katsoulacos. *The Economic Theory of Product Differentiation*. Cambridge: Cambridge University Press, 1991.

BellSouth, *BellSouth Regulatory Reform: A Nationwide Summary,* June 1995, Issue No. 17.

Benson, Peter. "The Interorganizational Network as a Political Economy. " *Administrative Sciences Quarterly* 20 (1975): 229-249.

Berg, Sanford V. "A New Index of Telephone Service Quality: Academic and Regulatory Review." In *Quality and Reliability of Telecommunications Infrastructure*, ed. William Lehr. Mahwah, NJ: Lawrence Erlbaum Associates, 1995.

Berg, Sanford V. and John G. Lynch, Jr. "The Measurement and Encouragement of Telephone Service Quality." *Telecommunications Policy* (April 1992): 210-224.

Bernt, Phyllis. *Regulatory Implications of Alternative Network Models for the Provision of Telecommunications Services.* Columbus, OH: The National Regulatory Research Institute, 1994.

Berry, L. L. and A. Parasuraman. *Marketing Services.* New York: The Free Press, 1991.

Besanko, David, Shabtai Donnenfeld, and Lawrence J. White. "Monopoly and Quality Distortion: Effects and Remedies." *Quarterly Journal of Economics* (November 1987): 743-767.

_____. "The Multiproduct Firm, Quality Choice, and Regulation." *Journal of Industrial Economics* 36, no. 4 (1988): 411-429.

Besen, Stanley M. and Garth Saloner. "The Economics of Telecommunications Standards." In *Changing the Rules: Technological Change, International Competition, and Regulation in Communications,* eds. R. W. Crandall and K. Flamm. Washington, D.C.: Brookings Institution, 1989, 177-200.

Besen, Stanley M. and Leland L. Johnson. *Compatibility Standards, Competition, and Innovation in the Broadcasting Industry.* Santa Monica, CA: The RAND Corporation, 1986.

Blank, Larry R. "The Minimum Subscribership Plan (MSP): Quality, Prices, and Current Policy." Presentation at the 23rd Annual Telecommunications Policy Research Conference, Solomons, MD, Oct. 2, 1995.

_____. "Choosing Inefficiency: Why Regulators Combine Price and Rate-of-Return Restraints." Working Paper. Columbus, OH: The Ohio State University, 1995.

Blank, Larry R., Vivian Witkind Davis, and Catherine Reed. *Telecommunications Infrastructure Investments and State Regulatory Reform: A Preliminary Look at the Data.* Columbus, OH: The National Regulatory Research Institute, 1994.

Blank, Larry R., David Kaserman, and John Mayo. "Dominant Firm Pricing with Competitive Entry and Regulation: The Case of IntraLATA Toll." Working Paper. Knoxville, TN: The University of Tennessee, 1995.

Bolter, Walter G., James W. McConnaughey, and Fred J. Kelsey. *Telecommunications Policy for the 1990s and Beyond*. Armonk, NY: M. E. Sharpe, 1990.

Bozeman, Barry L. *All Organizations are Public: Bridging Public and Private Organization Theories*. San Francisco: Jossey-Bass, 1988.

Bradley, Keith. *Phone Wars: The Story of Mercury Communications*. London: Century Business, 1992.

Braeutigam, Ronald R. and John C. Panzar. "Effects of the Change from Rate-of-Return Regulation to Price-Cap Regulation." *American Economic Review* 83 (1993): 191-198.

Brennan, Timothy J. "Regulating by Capping Prices." *Journal of Regulatory Economics* 1 (1989): 133-147.

Breyer, Stephen. *Regulation and Its Reform*. Cambridge, Mass.: Harvard University Press, 1982.

Briere, D. and B. Guptill. "The ISDN Conundrum: Is It Already Too Late?" *Network World* 8, no. 45 (Nov. 11, 1991): 1.

Bryson, John M. and Peter S. Ring. "A Transaction-Based Approach to Policy Intervention." *Policy Sciences* 23 (1990): 205-229.

Burns, Robert E., Mark Eifert, and Peter A. Nagler. *Current PGA and FAC Practices: Implications for Ratemaking in Competitive Markets.* Columbus, OH: The National Regulatory Research Institute, 1991.

California Public Utilities Commission. *In the Matter of Application of Alternative Regulatory Frameworks for Local Exchange Carriers,* Decision 89-10-013. Sacramento, CA: California PUC, Oct. 12, 1989.

California Public Utilities Commission, Advisory and Compliance Division. *Monitoring Workshop II Report*, I-87-11-033, Phase 2. Sacramento, CA: California PUC, Sept. 25, 1990.

"California PUC Lowers Citizens Phone Rates, Including Reduction for Poor Service Quality." *NARUC Bulletin* 48-1995 (Nov. 27, 1995): 9.

Carlton, Dennis W. "The Economics of Cooperation and Competition in Electronic Services Network Industries." In *Electronic Services Networks*, ed. Guerin-Calvert and Wildman. New York: Praeger, 1991.

Carlton, Dennis W. and Jeffrey Perloff. *Modern Industrial Organization*, 2nd ed. New York: Harper Collins, 1994.

Carman, James A. "Consumer Perceptions of Service Quality: An Assessment of the SERVQUAL Dimensions." *Journal of Retailing* 66, no. 1 (spring 1990): 41.

Carroll, James D. "Participatory Technology." *Science* (February 1971): 648.

Casper Star Tribune, 29 Sept., 1994, 1 and 12.

Cauley, Leslie. "Baby Bells Face a Tough Balancing Act: Reputation for Service Is On the Line Amid Deep Staff Cuts." *Wall Street Journal*, 4 Jan., 1996, A2.

Cheit, Ross. *Setting Safety Standards: Regulation in the Public and Private Sectors*. Berkeley: University of California Press, 1990.

Clements, Michael. "Regulatory Reform and Modern Infrastructure Deployment in the Telecommunications Industry." *NRRI Quarterly Bulletin* 16, no. 4 (1995): 549-567.

Coase, Ronald H. "The Nature of the Firm." *Economica* (November 1937): 386-405.

Collier, David A. *The Service/Quality Solution: Using Service Management to Gain Competitive Advantage.* Milwaukee, WI: ASQC Quality Press, 1994.

Colorado Public Utilities Commission. *Regarding the Applications of the Mountain States Telephone and Telegraph Company D/B/A U S West Communications, for Approval of the Rate and Service Regulation Plan,* Docket 90-A-665T, Decision C92-854, Exhibit A. Denver, CO: Colorado PUC, May 26, 1992.

Colorado Public Utilities Commission. *Rules Regulating Telecommunications Service Providers and Telephone Utilities,* 4CCR 723-2. Denver, CO: Colorado PUC, 1994.

"Colorado Staff Proposes Consumer Bill of Rights." *Telecommunications Reports* 61, no. 38 (Sept. 25, 1995): 26-27.

Connecticut Department of Public Utility Control. *Application of the Southern New England Telephone Company to Amend Its Rates and Rate Structure,* Docket No. 92-09-19. New Britain, CT: Connecticut DPUC, July 7, 1993.

Consultative Committee for International Telephone and Telegraphy. *Integrated Systems Digital Network,* First Report. CCITT, 1984.

Crawford, D. "CEOs Unite to Influence U.S. Technology Policy." *Communications of the ACM* 34, no. 6 (1991): 15-18.

"Customer Care Special," supplements to *Telephony* (Nov. 6, 1995).

David, Paul A. and Shane Greenstein. "The Economics of Compatability Standards: An Introduction to Recent Research." *Economic Innovation and New Technology* 1 (1990): 3-41.

David, Paul A. and W. Edward Steinmueller. "Economics of Compatibility Standards and Competition in Telecommunications Networks." *Information Economics and Policy* 6 (1994): 217-241.

Davidow, Harry. "Statement of AT&T." *Proceeding on Motion of the Commission to Investigate Performance Based Incentive Regulatory Plans for New York Telephone Company*, Case 92-C-0665, 1, Xerox.

Davis, Vivian Witkind, Raymond W. Lawton, and Edwin A. Rosenberg. *An Analysis of Selected Aspects of Ohio Bell Telephone's Application for Alternative Regulation: Price Caps, Service Classifications and Infrastructure Commitments.* Columbus, OH: The National Regulatory Research Institute, 1994.

Delaware Public Service Commission. *In the Matter of the Proposed Adoption of Regulation Governing the Minimum Service Requirement for the Provision of Telephone Service for Public Use Within the State of Delaware,* Order No. 3232. Delaware PSC, Jan. 15, 1991.

Deming, W. Edwards. *Out of the Crisis*. Cambridge, MA: MIT Center for Advanced Engineering Study, 1986.

de Sola Pool, Ithiel. *Technologies of Freedom.* Cambridge, MA: Harvard University Press, 1983.

District of Columbia Public Service Commission. *In the Matter of the Investigation into the Impact of the AT&T Divestiture and Decisions of the Federal Communications Commission on the Chesapeake and Potomac Telephone Company's Jurisdictional Rates,* Formal Case 814, Phase III, Order No. 10483. Washington, DC: District of Columbia PSC, Aug. 26, 1994.

Economides, Nicholas. "Desirability of Compatibility in the Absence of Network Externalities." *American Economic Review* 79, no. 5 (1989):1165-1181.

_____. "Compatibility and the Creation of Shared Networks." In *Electronic Services Network,* ed. Guerin-Calvert and Wildman. New York: Praeger, 1991.

Elmore, Richard F. "Instruments and Strategies in Public Policy." *Policy Studies Review* 7, no. 1 (1987): 174-186.

Eriksson, Ross C., David L. Kaserman, and John W. Mayo. "Targeted and Untargeted Subsidy Schemes: Evidence from Post-Divestiture Efforts to Promote Universal Telephone Service." Working Paper. Knoxville, TN: University of Tennessee, 1995.

Exchange Carriers Standards Association. *ECSA 1992 Annual Report.* Washington, DC: ECSA, Circa 1992.

Farrell, Joseph and Garth Saloner. "Standardization, Compatibility, and Innovation." *RAND Journal of Economics* 16, no. 1 (1985): 70-83.

Federal Communications Commission. *Integrated Systems Digital Network, Notice of Inquiry* 94 F.C.C.2d 1289 (1983).

_____. *Integrated Systems Digital Network, First Report*, 55 R.R.2d 1107 (1984).

Food Labeling News 2, no. 45 (Aug. 11, 1994): 1064.

Garvin, David A. "Competing on the Eight Dimensions of Quality." *Harvard Business Review* 87, no. 6 (1987): 101-109.

Greenstein, Shane, Susan McMaster, and Pablo Spiller. "The Effect of Incentive Regulation on Infrastructure Modernization: Local Exchange Companies' Development of Digital Technology." *Journal of Economics and Management Strategy* 4 (summer 1995): 188-236.

Hack, David. *Telecommunications and Information Systems Standardization–Is America Ready?* Report no. 87-458 SPR. Washington, D.C.: The Library of Congress: Congressional Research Service, 1987.

Harter, Phillip. "A View from the OSHA Task Force: Voluntary Standards Used in Regulation." *ASTM Standardization News* 5, no. 5 (May 1977).

Hausman, Jerry, Timothy Tardiff, and Alexander Belinfante. "The Effects of the Breakup of AT&T on Telephone Penetration in the United States." *American Economic Review, Papers and Proceedings* 83, no. 2 (1993): 178-184.

Hazlett, Thomas W. "Rate Regulation and the Quality of Cable Television." In *Quality and Reliability of Telecommunications Infrastructure,* ed. William Lehr. Mahwah, NJ: Lawrence Erlbaum Associates, 1995.

Heckathorn, Douglas D. and Steven M. Maser. "Bargaining and the Sources of Transaction Costs: The Case of Government Regulation." *Journal of Law, Economics, and Organizations* 3, no. 1 (1987): 69-98.

Hedvall, Maj-Britt and Mikael Paltschik. "Intrinsic Service Quality Determinants for Pharmacy Customers." *International Journal of Service Industry Management* 2, no. 2 (1991): 38-48.

Illinois Commerce Commission. *Illinois Bell Telephone Company Petition to Regulate Rates and Charges of Noncompetitive Services under an Alternative Form of Regulation* and *Complaint for an Investigation and Reduction of Illinois Bell Telephone Company's Rates under Article IX of the Public Utilities Act*, Docket No. 92-0448/93-0239. Chicago, IL: Illinois CC, Oct. 11, 1994.

Johnson, Alan. "PUCO Orders Probe of Ameritech." *Columbus Dispatch,* 11 Aug., 1995.

Johnson, Leland L. *Toward Competition and Cable Television.* Cambridge, MA: MIT Press, 1994.

Jones, Douglas N., et al. *Regional Regulation of Public Utilities: Opportunities and Obstacles*. Columbus, OH: The National Regulatory Research Institute, 1992.

Joskow, Paul. "The Determination of the Allowed Rate of Return in a Formal Regulatory Hearing." *Bell Journal of Economics and Management Science* 3 (1972): 632-44.

Joskow, Paul. "Pricing Decisions of Regulated Firms: A Behavioral Approach." *Bell Journal of Economics and Management Science* 4 (1993): 118-140.

_____. "Inflation and Environmental Concern: Structural Change in the Process of Public Utility Price Regulation." *Journal of Law and Economics* 17 (1974): 291-327.

Kaserman, David L. And Richard C. Tepel. "The Impact of Automatic Adjustment Clause on Fuel Purchase and Utilization Practices in the U.S. Electric Utility Industry." *Southern Economic Journal* (1982): 687-700.

Katz, Michael L. and Carl Shapiro. "Network Externalities, Competition, and Compatibility." *American Economic Review* 75, no. 3 (1985): 424-440.

Kihlstrom, Richard E. and David Levhari. "Quality, Regulation and Efficiency." *Kyklos* 30 (1977): 214-234.

Knight, Ivor. "Telecommunications Standards Development: Why Standard Bodies Can't Keep Up With the Demand, and What Needs To Be Done." *Telecommunications* (January 1991): 28-42.

Kraushaar, Jonathan. "Quality of Service Measurement." In *Quality and Reliability of Telecommunications Infrastructure*, ed. William Lehr. Mahwah, NJ: Lawrence Erlbaum Associates, 1995.

Kwoka, John. "Implementing Price Caps in Telecommunications." *Journal of Policy Analysis and Management* 12 (fall 1993): 726-752.

Laffont, Jean-Jacques and Jean Tirole. *A Theory of Incentives in Procurement and Regulation*. Cambridge, MA: MIT Press, 1993.

Landsbergen, David. "Establishing Telecommunications Standards: A Problem of Procedures and Values." *Informatization and the Public Sector* 2, no. 4 (1992): 392-346.

Lawton, Raymond W. "Network Utilization Principles and Pricing Strategies for Network Reliability." In *Quality and Reliability of Telecommunications Infrastructure,* ed. William Lehr. Mahwah, NJ: Lawrence Erlbaum Associates, 1995.

Lawton, Raymond, et al. *Measuring the Impact of Alternative Regulatory Pricing Reforms in Telecommunications.* Columbus, OH: The National Regulatory Research Institute, 1994.

Leffler, Keith B. "Ambiguous Changes in Product Quality." *American Economic Review* 72 (1982): 956-967.

Lehr, William. *Quality and Reliability of Telecommunications Infrastructure*. Mahwah, NJ: Lawrence Erlbaum Associates, 1995.

Leland, Hayne E. "Quacks, Lemons, and Licensing: A Theory of Minimum Quality Standards." *Journal of Political Economy* 87, no. 6 (1979): 1328-1346.

Levhari, David and Yoram Peles. "Market Structure, Quality and Durability." *Bell Journal of Economics* 4 (1973): 235-248.

Lewis, R. C. and B. M. Booms. "The Marketing Aspects of Service Quality." In *Energy Perspectives on Service Marketing*, ed. L. L. Berry. Chicago: American Marketing Association, 1983, 99-104.

Lewis, Tracy R. and David E. M. Sappington. "Incentives for Monitoring Quality." *RAND Journal of Economics* 22, no. 3 (1991): 370-384.

Lynch, John G. Jr., Thomas E. Buzas, and Sanford V. Berg. "Regulatory Measurement and Evaluation of Telephone Service Quality." *Management Science* 40, no.2 (February 1994): 169-194.

"Making Service the Competitive Battlefield." *Global Telecoms Business* 10 (June/July 1995).

Massachusetts Department of Public Utilities. D.P.U. 89-300. Boston, MA: Massachusetts DPU, June 29, 1990.

Matthews, Steven and Andrew Postlewaite. "Quality Testing and Disclosure." *RAND Journal of Economics* 16, no. 3 (1985): 328-340.

Matutes, Carmen and Pierre Regibeau. "'Mix and Match': Product Compatibility without Network Externalities." *RAND Journal of Economics* 19, no. 2 (1988): 221-234.

Meier, Kenneth J. *Politics and the Bureaucracy: Policymaking in the Fourth Branch of Government,* 2nd ed. Monterey, CA: Brooks/Cole, 1987.

Michigan Public Service Commission. *In the Matter, on the Commission's Own Motion, to Establish Quality of Service Standards for Regulated Telecommunications Services under the Michigan Telecommunications Act*, Case No. U-10063. Lansing, MI: Michigan PSC, Sept. 11, 1992.

Mississippi Public Service Commission. *Order of the Mississippi Public Service Commission Establishing a Docket to Consider Formulating a Properly Structured Price Regulation Plan for South Central Bell,* Final Order, Docket 95-UA-313, attachment: "Price Regulation Evaluation Plan." Jackson, MS: Mississippi PSC, Nov. 1, 1995.

Mussa, Michael and Sherwin Rosen. "Monopoly and Product Quality." *Journal of Economic Theory* 18 (1978): 301-317.

Nakarado, Gary L. "Customer-Based Regulation: Could It Work if We Knew What Customers Wanted?" Paper presented at the 24th Annual Institute of Public Utilities, Williamsburg, Virginia, December 1992. Unpublished Xerox, 1.

National Association of Regulatory Utility Commissioners. *Telephone Service Quality Handbook*. Washington, D.C.: NARUC, 1992.

The National Regulatory Research Institute. *Missions, Strategies and Implementation Steps for State Public Utility Commissions in the Year 2000: Proceedings of the NARUC/NRRI Commissioners Summit*. Columbus, OH: NRRI, 1995.

National Research Council (U.S.) NRENAISSANCE Committee, Leonard Kleinrock, Chair. *Realizing the Information Future: The Internet and Beyond.* Washington, DC: National Academy Press, 1994.

Nevada Public Service Commission. Docket No. 89751/91-2068, May 20, 1991.

New Jersey Board of Public Utilities. *In the Matter of the Applications of New Jersey Bell Telephone Company for Approval of Its Plan for an Alternative Form of Regulation*, Docket No. T092030358. Trenton, NJ: New Jersey BPU, May 6, 1993.

New Mexico State Corporation Commission. *In the Matter of the Held Orders of U S West Communications,* Docket No. 94-192-TC. Santa Fe, NM: New Mexico SCC, Nov. 14, 1994.

New York Public Service Commission. *Opinion and Order Approving Joint Stipulation and Agreement, Petition of Rochester Telephone Corporation for Approval of Proposed Restructuring Plan,* Case 93-C-0103 and *Petition of Rochester Telephone Corporation for Approval of a New Multi-Year Rate Stability Agreement*. Albany, NY: New York PSC, Nov. 10, 1994.

New York Public Service Commission. Opinion No. 95-13, issued Aug. 16, 1995, *Adoption of Performance Based Regulation Plan for New York Telephone,* Case No. 992-C-0665. Albany, NY: New York PSC, Aug. 16, 1995.

Noam, Eli M. "Toward an Integrated Communications Market: Overcoming the Local Monopoly of Cable Television." *Federal Communications Law Journal* 34 (1982): 209-256.

_____. "The Quality of Regulation in Regulating Quality: A Proposal for an Integrated Incentive Approach to Telephone Service Performance." In *Price Caps and Incentive Regulation in Telecommunications,* ed. Michael Einhorn. Boston: Kluwer Academic Publishers, 1991: 168-189.

_____. "Beyond Liberalization: From the Network of Networks to the System of Systems." *Telecommunications Policy* 18 (1994): 687-704.

Norsworthy, John R. and James C. MacDonald. "Service Quality at Large Local Exchange Carriers: Is There a Tradeoff Between Efficiency and Quality?" In *Proceedings of the Ninth NARUC Biennial Regulatory Information Conference.* Columbus: NRRI, 1994), 393-421.

"N.C., Idaho Consider New Telco Price Regulation Schemes." *State Telephone Regulation Report* 13, no. 22 (Nov. 22, 1995): 2.

Northern Telecom Inc. *Residential Services Software Dependencies*. Nashville, TN: Northern Telecom Inc., December 1990, 1-3.

"Nynex Faces $121 million in Penalties: Regulator." *Investor's Business Daily,* 26 Feb., 1995, A 19.

Oregon Public Utility Commission. *In the Matter of the Petition of U S West Communications, Inc. To Price-List Telecommunications Services Other than Essential Local Exchange Services*, Order No. 91-1598. Salem, OR: Oregon PUC, Nov. 25, 1991.

Organization for Economic Co-Operation and Development. *Performance Indicators for Public Telecommunications Operators*. Paris: OECD, 1990.

"PacBell to Launch Massive ISDN Push." *PC WEEK,* 3 April, 1995, 1.

Pennsylvania Public Utility Commission. *Declaratory Order re LEC Billing of Pay-Per-Call and Similar Information Services,* Docket No. M-00940569. Harrisburg, PA: Pennsylvania PUC, July 21, 1994.

Peterson, H. Craig. *Business and Government*, 4th ed. New York: Harper Collins, 1993.

Phillips, Charles F., Jr. *The Regulation of Public Utilities*. Arlington, VA: Public Utilities Reports, 1993.

Phlips, Louis. *The Economics of Price Discrimination*. Cambridge, MA: Cambridge University Press, 1983.

Porter, Michael E. *Competition in Global Industries.* Boston: Harvard Business School Press, 1986.

"Price Regulation Plan for Ameritech-Illinois Approved." *Telecommunications Reports* 60, no. 42 (Oct. 17, 1994): 16.

Public Utilities Commission of Ohio. *In the Matter of the Application of The Ohio Bell Telephone Company for Approval of an Alternative Form of Regulation*, Case No. 93-487-TP-ALT and *In the Matter of the Complaint of the Office of the Consumers' Counsel* v. *The Ohio Bell Telephone Company*, Case No. 93-576-TP-CSS. Columbus, OH: Ohio PUC, Nov. 23, 1994.

Rau, Narayan S. and Yousef Hegazy. *Reliability Differentiated Pricing of Electricity Service*. Columbus, OH: The National Regulatory Research Institute, 1990.

Ravozzi, Laura and David Thompson. "The Regulation of Product Quality in the Public Utilities and the Citizen's Charter." *Fiscal Studies* 13:3 (1992): 84-85.

Reagan, Michael D. *Regulation: The Politics of Policy.* Boston: Little, Brown and Co., 1987.

Reddy, N. M. "International Standardization of Technical Products." *Technovation* 10, no. 6 (1987): 407-417.

Rhode Island Public Utilities Commission. *In Re: Comprehensive Review of Telecommunications in Rhode Island*, Docket No. 1997, Order No. 14038. Providence, RI: Rhode Island PUC, Oct. 6, 1992.

Richters, John S. and Charles A. Dvorak. "A Framework for Defining the Quality of Communications Services. *IEEE Communications Magazine* (October 1988): 19-23.

Ripley, Randall A. and Grace A. Franklin. *Policy Implementation and Bureaucracy,* 2nd ed. Chicago: Dorsey Press, 1986.

Ronnen, Uri. "Minimum Quality Standards, Fixed Costs, and Competition." *RAND Journal of Economics* 22, no. 4 (1991): 490-491.

Rosenberg, Edwin A., et al. *Regional Telephone Holding Companies: Structures, Affiliate Transactions, and Regulatory Options*. Columbus, OH: The National Regulatory Research Institute, 1993.

Rubinovitz, Robert N. "Market Power and Price Increases for Basic Cable Service Since Deregulation." *RAND Journal of Economics* 24, no. 1 (1993): 1-18.

Rutkowski, Anthony M. "The Integrated Services Digital Network: Issues and Options for the Future." *Jurimetrics* 24, no. 1 (1983): 19-42.

Salop, Steven C. "Monopolistic Competition with Outside Goods." *Bell Journal of Economics* 10 (spring 1979): 141-156.

Schmalensee, Richard. "Market Structure, Durability and Quality: A Selective Survey." *Economic Inquiry* XVII (April 1979): 177.

_____. "Regulation and the Durability of Goods." *Bell Journal of Economics and Management Science* 1 (spring 1970): 54-64.

Shapiro, Carl. "Premiums for High Quality Products as Returns to Reputations." *Quarterly Journal of Economics* (November 1983): 659-679.

Sheshinski, Eytan. "Price, Quality, and Quantity Regulation in Monopoly Situations." *Economica* 43 (May 1976): 127-137.

Shin, Richard T. and John S. Ying. "Unnatural Monopolies in Local Telephone." *RAND Journal of Economics* 23 (summer 1992): 171-183.

Smith, Adam. *An Inquiry into the Nature and Causes of the Wealth of Nations,* ed. Edwin Cannan. New York: The Modern Library, 1937.

Spence, Michael A. "Monopoly, Quality, and Regulation." *Bell Journal of Economics* 6 (1975): 417-429.

Tennessee Public Service Commission. *Regulatory Reform Plan for Telephone Companies,* Rule 1220-4-2.43. Nashville, TN: Tennessee PSC, July 31, 1990.

_____. *Regulatory Reform,* Rule 1220-4-2.55. Nashville, TN: Tennessee PSC, Nov. 13, 1992.

Tennessee Statute HB 695/SB891. Enacted June 6, 1995.

Texas Statute HB 2128. May 26, 1995.

Tirole, Jean. *The Theory of Industrial Organization.* Cambridge, MA: MIT Press, 1988.

"U S West Fined for Bad Service," *State Telephone Regulation Report* 13, no. 15 (Aug. 10, 1995): 14.

Vermont Public Service Board. *Vermont Telecommunications Agreement I.* Montpelier, VT: Vermont PSC, 1988.

Washington Utilities and Transportation Commission. *The 1989 Report on the Status of the Washington Telecommunications Industry.* Submitted to the Washington State Legislature. Olympia, WA: Washington UTC, Jan. 27, 1989.

Weikle, Jerry L. "Open Your Eyes to Wise Guys." *Rural Telecommunications* (September/October 1995): 43-46.

Weiss, M. B. H. and M. Sirbu. "Technological Choice in Voluntary Standards Committees: An Empirical Analysis." *Economics of Innovation and New Technology* 1 (1990): 111-113.

White, Lawrence J. "Quality Variation when Prices are Regulated." *Bell Journal of Economics and Management Science* 3, no. 2 (1972): 425-436.

Williamson, Oliver E. "Transaction-Cost Economics: The Governance of Contractual Relations." In *Organizational Economics,* ed. B. Barney and William G. Ouchi. San Francisco, CA: Jossey-Bass, 1986.

Wohlstetter, John C. "Gigabits, Gateways, and Gatekeepers: Reliability, Technology, and Policy." In *Quality and Reliability of Telecommunications Infrastructure,* ed. William Lehr. Mahwah, NJ: Lawrence Erlbaum Associates, 1995, 225.

Wolf, Charles. "A Theory of Non-Market Failures." *The Public Interest* 55 (spring 1979): 114-133.

Zeithaml, V. A., A. Parasuraman and L. L. Berry. *Delivering Quality Service.* New York: The Free Press, 1990.