Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
The Open Internet Remand	)	**GN Docket No. 14-28**

COMMENTS OF THE CONSUMER FEDERATION OF AMERICA

Mark Cooper,
Director of Research
July 15, 2014

CONTENTS

List of Exhibits

SUMMARY

THE INTERNET INNOVATION SYSTEM, EVOLUTION OF PROGRESSIVE CAPITALISM IN THE INDUSTRIAL AGE

At the core of the success of the digital revolution is a widely recognized and unique innovation system that creates "virtuous cycles" of innovation and investment. Driven by entrepreneurial experimentation at the edge of the network demand for new services is created that elicits investment in network capacity and functionality. This, in turn, stimulates further experimentation at the edge and new demand and the cycle is repeated.

To its credit, the Federal Communications Commission (FCC) used the concept of the "virtuous cycle" as the foundation of its National Broadband Plan and its Open Internet Order. To its even greater credit, the D.C. Circuit Court of Appeals accepted the "virtuous cycle" in upholding the FCC's authority to adopt policies to promote the "timely and reasonable" deployment of broadband. The challenge for the Commission is to develop a regulatory framework that protects and advances the "virtuous cycle," so that broadband deployment and adoption is stimulated.

In order to accomplish this goal, these comments argue that the FCC must understand the dynamic nature of the Internet innovation system as the most recent development in the long history of the development of progressive capitalism in the industrial age. To do so the comments present analysis of the "virtuous cycle" of the Internet innovation system based on reviews of several relevant economic literatures, including general purpose technologies, innovation diffusion, innovation systems, technology revolutions and market success and failure.

THE POLICY AND REGULATORY CHALLENGE

The challenge the FCC faces is to develop a regulatory system that supports the key attributes of the Internet innovation system, which is driven by entrepreneurial innovation at the edge of the communications network. The key conditions that made the "virtuous cycle" possible on an unprecedented scale include, at the micro level.

- neutrality of the communications protocols and network devices,
- no need to engage in costly bilateral negotiation over the cost and quality of access,
- interoperability,
- an unprecedented degree of user-driven innovation,
- open standards,
- growth and importance of platforms, and
- new relationships to capital markets (i.e. the large role of venture capitalists).

The expansion of entrepreneurial experimentation at the edge is further supported by structural conditions that emerged as the digital techno-economic paradigm developed, including:

- an increase in the division of labor,
- divided and diverse technical platform leadership,
- specialization of supply firms,
- direct and indirect network effects,
- knowledge flows, and
- learning externalities.

To preserve the Internet innovation system, the FCC must adopt a regulatory system that prevents unregulated action by communications network owners from undermining or weakening the "virtuous cycle." The analysis shows that, given the location and importance of network owners in the digital communications platform, unregulated pursuit of their private interests is likely to diminish innovation at the edge in a number of ways.

- Their actions can dampening the willingness and ability of the edge to experiment:
    - imposing counterproductive "worry" about the network and its devices,
    - undermining interoperability,
    - increasing costs substantially by forcing edge entrepreneurs to engage in bilateral negotiation, and
    - chilling innovation through the threat of "hold up" of successful edge activities.

- As incumbents they have a conservative, myopic bias and are likely to be far less innovative and dynamic than the edge based on a
    - preference for preserving the old structure,
    - pursuit of incremental, process innovation rather than radical, product innovation, and
    - a proprietary culture that prefers restrictions on the flow of knowledge.
- Competition is much weaker in the network segment of the digital platform than in the edge segments, which means network owners
    - face less pressure to innovate,
    - have the ability to influence industrial structure to favor their interests at the expense of the public interest.
    - can use vertical leverage (where they are integrated) to gain competitive advantage over independent edge entrepreneurs, and
    - have the ability to extract rents, where they possess market power or where switching costs are high.

THE MODEL OF SUCCESSFUL REGULATION IN THE DIGITAL AGE

Analysis of the success of the Internet shows that the model for promoting entrepreneurial experimentation at the edge and preventing harmful behavior in the center of the digital communications ecology is already in hand, embodied in past FCC regulatory decisions. In the Carterphone, Computer Inquiries and unlicensed spectrum decisions, the FCC adopted bright lines that guaranteed access to communications bottlenecks. These clear and simple rules allowed extensive and intensive entrepreneurial experimentation, but did not require the involvement of the regulator in the day-to-day operation of the communications protocols or entrepreneurial activity.

Multi-stakeholder, self-regulatory institutions developed to manage the space that was protected by FCC policy. While these voluntary efforts were vital to the success of the Internet innovation, it is a mistake to believe that they would have succeeded without the strong action of the FCC to create and preserve the space of freedom for entrepreneurial experimentation. It is also important to recognize that these efforts were led by new entrants and innovators, not dominant incumbent network owners.

Law and economics are converging. Recent rulings of two Federal Appeals Courts have upheld the Commission's ability to regulate broadband Internet access service for the purposes of achieving the broad goals of the Communications Act under several Titles and Sections of the Act. The Data Roaming and Open Internet rulings by the D.C. Court of Appeals and the Universal Service Reform ruling of the 10th Circuit Court of Appeals grant the FCC authority to deal with four of the six public service principles that CFA identified as vital to ensure that consumers enjoy the full benefits of the digital communications revolution (interconnection, nondiscrimination, universal service and innovation at the edge, See Appendix A).

These comments reinforce our earlier recommendation that showed why the prudent approach for the FCC to take is to pursue full section 706 authority and explore where Title II authority would be necessary.

IMPLEMENTING SECTION 706 AUTHORITY

Our reading of the recent court decisions makes it clear that there is no legal conflict in simultaneously exercising section 706 authority and Title II authority. Moreover, the analysis of "virtuous cycles" and the need to develop regulatory institution to support the current phase of progressive capitalist development suggests that the factual basis to justify either section 706 authority or Title II authority should rest on an analysis of the "virtuous cycles" of the Internet innovation system.

Transparency

The most obvious place to start in building the new regulatory model is with enhancement of the transparency rules, which were upheld by the Court. Throughout the economic analyses of the Internet innovation system users loom large not only as a source of information, but also as active innovators. Yet, when the topic of regulatory reform of comes up, consumers tend to disappear. There is no reason that consumers cannot be just as involved in the regulatory process as they have become in the innovative process. They are capable of a lot more than two sentence e-mails complaining about something.

The Commission should to ensure that input from civil society can effectively influence the definition and enforcement of acceptable behavior. This means that

- multi-stakeholder input must occur before, during and after the adoption of rules or norms,
- complaints must be handled on an expedited basis, and
- The process must be recognized by the FCC, which should ensure that it is representative and transparent.

No blocking

A second principle that emerges clearly from the discussion of the Internet innovation system is that network operators should not be allowed to block applications. Although the Court overturned the FCC's ban on blocking, it seemed willing to uphold a well=crafted ban. The no blocking rule should ensure that the data traffic flows during any negotiations over rates, terms and conditions. The Commission should propose such a rule under section 706. It could also assert Title II authority for the no blocking rule.

Non-discrimination

The D.C. Circuit ruling concludes that flexibility must be offered to market participants to negotiate arrangements, subject to the oversight of the Commission. While this is consistent with the objective of promoting experimentation at the edge, it imposes a burden on the ability of edge companies to innovate. In order to minimize the burden on the Internet innovation system, the Commission can impose conditions on the process of negotiation and identify the factors that will be used to evaluate outcomes.

- In terms of process, the Commission should require that

    - The data traffic flows during the negotiations – this is a natural extension of the no blocking principle.
    - Self-help should be deemed reasonable, i.e. edge companies that propose to deploy facilities or protocols that solve network problems or enhance the capacity or functionality of the network, should be deemed to be reasonable.
    - The burden of proving that the rates, terms and conditions a network operator wants to impose are reasonable should fall on the network operator.
- In terms of substance, the rates, terms and conditions that are reasonable should be evaluated by a series of specific factors:
    - No degrade the service of the general public,
    - Non-exclusive,
    - Not anticompetitive,
    - Non-discriminatory,
    - Demonstrate a need for differentiation based on cost or quality of service

SELECTIVE USE OF TITLE II AUTHORITY

These comments point out that there are two ways in which Title II authority can be asserted – classifying new telecommunications services as Title II services or reclassifying broadband Internet access service as a telecommunications service. In both cases, the premise is that developments since the decision to classify broadband Internet access service as an information service compel the Commission to revisit that decision given it responsibility to pursue the goals of the Act.

Justification for Title II Authority

While section 706 preserves the scope of individual action and flexibility that has been the hallmark of the successful regulatory model, it is important to recognize that the legal terrain on which the FCC that goal has shifted. The authority on which much of the Internet regulation rested (ancillary authority) has been twice rejected the D.C. Circuit Court of Appeals. The manner in which the D.C. Circuit Court has interpreted the FCC's Section 706 authority gives the FCC a different and narrower set of powers than ancillary authority did. Simply put, the

D.C. Appeals Court's interpretation of section 706 does not allow bright lines to be drawn. If the FCC concludes that it needs more power – i.e. that actions are needed that cannot be taken under section 706 – it should assert Title II authority for those specific actions. This invites a reconsideration of the decision to classify broadband Internet access as an information service.

There is no doubt that the legal and economic terrain on which the decision to classify broadband Internet access service as an information service have changed significantly.

- The passage of the Broadband Data Act (2008) and the American Revival and Revitalization Act (2009) have shifted the focus of universal service policy to recognize the importance of adoption and utilization.
- The findings of the section 706 report that deployment of broadband is not timely and reasonable, not only provides direct justification of Commission Act, it shows that after more than a decade, the classification of broadband as an information service has failed to achieve the primary goal of the Act.
- The progress made toward establishing a new regulatory under Section 706 approach shines a spotlight on gaps that exist in the authorities the Commission has in pursuing the goals of the National Broadband Plan without Title II authority. The call for a transition to an all IP network magnifies the problem of inadequate authority. Beyond the open Internet concerns raised above,
    - Section 254 and 706 authority leave challenging questions about how to implement universal service funding (which falls under Title II) to promote broadband.
    - Section 255, which seeks to ensure communications functionality serves the needs of American's with disabilities also falls into a grey area.

Judicious Use of Title II Authority

New Telecommunications Services: Services that were non-existent or played a very small role at the time of the decision to classify broadband as an information service now make a very important contribution to the communications network in ways that may merit the classification as a telecommunications service. Interconnection with private telecommunications facilities and new telecommunications functionalities provided by Internet based-services provide telecommunications infrastructure and promote competition in exactly the manner the 1996 hoped. In the case of these services, the Information service classification can be an impediment to their contribution because are denied interconnection or their telecommunications capability is not recognized. These service also important to advance the "virtuous cycle" as innovation at the edge that could grow into full blown competition.

Reclassification: Reclassification of broadband Internet access service would certainly give the FCC more power to deal with the wide range of issues that were left unresolved by the information service classification, but simply classifying broadband Internet access service as a Title II service does not fill the gaps. The FCC must also conclude that specific practices are unjust, unreasonable and unduly discriminatory to ban them under Title II. Drawing bright lines before the fact will provide greater certainty once the rulemakings and litigation are done. Therein lies the rub.

Utility/common carrier (Title II) regulation is about homogeneity and stability. It thrives in static environments and, inevitably, reinforces the stasis of the environment because it operates best by creating silos with categories of producers and consumers, definitions of acceptable behavior, and permissions required to act. These service categories and "does" and "don'ts" are hashed out in administrative proceedings and court cases that can stretch out for years or even decades. The cost of delay can be ignored because the sector is so static.

Digital communications networks are the antithesis of common carrier telecommunications networks. They thrive on diversity and prosper only where dynamic change is the key to success. In a dynamic environment, the costs of delay and the value of lost services – innovation that is never brought to market – are severe. "Brutally simple" bright lines that opened the way to entrepreneurial behavior are what worked in the past, not detailed regulation of behavior. Therefore, the use of Title II authority should be selective and targeted with specific harmful practices identified. The Communications Act gives it the flexibility to do in the form of regulatory forbearance (section 10). Thus the FCC should develop Open Internet rules that deliver network neutrality that fits the economic reality of the 21^{st} century digital economy

I. INTRODUCTION

A. CONSUMER FEDERATION OF AMERICA

The Consumer Federation of America (CFA) is an association of non-profit consumer organizations that was established in 1968 to advance the consumer interest through research, advocacy, and education. Today, nearly 300 of these groups participate in CFA and govern it through their representatives on the organization's Board of Directors and the annual Consumer Assembly.

CFA has been involved in communications, media and Internet policy for decades in legislative, regulatory and judicial arenas and has advanced the consumer view in policy and academic publications. In fact, CFA was among the first public interest groups to recognize the unique consumer value and importance of the emerging digital economy. In a paper published in January 1990 CFA described the key elements of the emerging model as follows: "[t]he fact that a great deal of the intelligence is currently located on the periphery of the information age network has led to a pragmatic, decentralized pattern of development."[1] CFA warned that the effort to assert centralized control over the Internet by telephone and cable companies "could set the information age development back by undermining the diversified, innovative process of the current decentralized approach."[2]

In the quarter century since CFA first looked at the digital revolution from the consumer/public interest point of view, we have not only participated in virtually every regulatory proceeding involving the important issue of access to the Internet, we have also published over four dozen research reports, conference papers, journal articles, chapters and

[1] Mark Cooper, *Expanding the Information Age for the 1990s: A Pragmatic Consumer Analysis,* January 11, 1990:ES-1
[2] Cooper, 1990:12.

books on these and closely related topics (see Exhibit I-1). These comments present a series of analyses that build on that work and focus it on the issues raised in this proceeding.

EXHIBIT I-1: CFA RESEARCH REPORTS, CONFERENCE PAPERS, JOURNAL ARTICLES, CHAPTERS AND BOOKS, RELEVANT TO THE OPEN INTERNET RULEMAKING

"The Long History and Increasing Importance of Public Service Principles For 21st Century Public Digital Communications Networks," *Journal on Telecommunications and High Technology Law*, 2014

"From the Public Switched Telephone Network to the Public Digital Communications Network: Interconnection, Interoperability, Universal Service & Innovation at the Edge," *Interconnection Policy for the Internet Age, The Digital Broadband Migration: The Future of Internet-Enabled Innovation, Silicon Flatirons,* February 10-11, 2013

Energy Efficiency Performance Standards: The Cornerstone of Consumer-Friendly Energy Policy, October 2013

"Why Growing Up is Hard to Do: Institutional Challenges for Internet Governance in the "Quarter Life Crisis of the of the Digital Revolution," *Journal on Telecommunications and High Technology Law,* 2013. 11(1).

Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves: the Dramatic Success of Combining Market Principles and Shared Access, January 2012

"Structured Viral Communications: The Political Economy and Social Organization of Digital Disintermediation," *Journal on High Telecommunications and High Technology Law,* 9:1, 2011.

"Crowd Sourcing Enforcement: Building a Platform for Participatory Regulation in the Digital Information Age," presentation at *The Digital Broadband Migration: The Dynamics of Disruptive Innovation*, *Silicon Flatirons Ctr*. Feb. 12, 2011

"The Central Role of Wireless in the 21st Century Communications Ecology: Adapting Spectrum and Universal Service Policy to the New Reality," *Telecommunications Policy Research Conference*, September 2011

"The Failure Of Market Fundamentalism: What Are The Issues In The ICT Sector?" *The New Economics of ICT: Implications of Post-Neoclassical Economics for the Information Communications Technology Sector, Columbia University, March 20, 2009*

"Broadband in America: A Policy of Neglect is not Benign," in Enrico Ferro, Yogesh K. Dwivedi, J. Ramon Gil-Garcia, and Michael D. Williams, Eds., *Overcoming Digital Divides: Constructing an Equitable and Competitive Information Society,"* IGI Global Press, 2009.

Reform of Financial Markets: the Collapse Of Market Fundamentalism and the First Steps to Revitalize the Economy, April 2009

"Network Neutrality," *Toll Roads? The Legal and Political Debate Over Network Neutrality,* University of San Francisco Law School, January 26, 2008

"The Importance of Open Networks in Sustaining the Digital Revolution," in Thomas M. Lenard and Randolph J. May (Eds.) *Net Neutrality or Net Neutering* (New York, Springer, 2006)

"The Central Role of Network Neutrality in the Internet Revolution," *Public Interest Advocacy Center*, Ottawa Canada, November 24, 2006

"Governing the Spectrum Commons," September 2006. *Telecommunications Policy Research Conference*, October 2006

"The Economics of Collaborative Production: A Framework for Analyzing the Emerging Mode of Digital Production," *The Economics of Open Content: A Commercial Noncommercial Forum,* MIT January 23, 2006

"From Wifi to Wikis and Open Source: The Political Economy of Collaborative Production in the Digital Information Age," *Journal on Telecommunications and High Technology Law,* 5:1, 2006

"Collaborative Production in Group-Forming Networks: The 21st Century Mode of Information Production and the Telecommunications Policies Necessary to Promote It," *The State of Telecom: Taking Stock and Looking Ahead*, Columbia Institute on Tele-Information, October 2005

"The Economics of Collaborative Production in the Spectrum Commons," *IEEE Symposium on New Frontiers in Dynamic Spectrum Access Networks,* November 2005

"Too Much Deregulation or Not Enough," *Natural Gas and Electricity*, June 2005

"Information is a Public Good," *Extending the Information Society to All: Enabling Environments, Investment and Innovation, World Summit on the Information Society,* Tunis, November 2005

"Spectrum as Speech in the 21st Century," *The Public Airwaves as a Common Asset and a Public Good: Implications for the Future of Broadcasting and Community Development in the U.S.,* Ford foundation, March 11, 2005

"Dividing the Nation, Digitally: When a Policy Of Neglect is Not Benign," *The Impact of the Digital Divide on Management and Policy: Determinants and Implications of Unequal Access to Information Technology,* Carlson School of Management, University of Minnesota, August 28, 2004.

"Open Communications in Open Economies and Open Societies: Public Interest Obligations are Vital in the Digital Information Age," *Convergence: Broadband Policy and Regulation Issues for New Media Businesses in the New Millennium* Georgetown University Law Center, Advanced Computer and Internet Law Institute March 5, 2003.

Expanding the Digital Divide and Falling Behind in Broadband (Consumer Federation of America and Consumers Union, October 2004)

The Public Interest in Open Communications Networks (Consumer Federation of America, July 2004)

Open Architecture as Communications Policy (Stanford Law School, Center for Internet and Society: 2004)

"The Political Economy Of Spectrum Policy: Unlicensed Use Wins Both The Political (Freedom Of Speech) And Economic (Efficiency) Arguments," *Spectrum Policy: Property Or Commons?* Stanford Law School, March 1, 2003

"What's 'New" About Telecommunications in the 21st Century Economy: Not Enough to Abandon Traditional 20th century Public Interest Values" *Models of Regulation For the New Economy*, University of Colorado School of Law, February 1, 2003

"Restoring the Balance of Public Values and Private Incentives in American Capitalism," *Too Much Deregulation or Not Enough,* Cato Institution, November 1, 2002

Cable Mergers and Monopolies: Market Power In Digital Media and Communications Networks (Washington, D.C.: Economic Policy Institute, 2002)

Does the Digital Divide Still Exist? Bush Administration Shrugs, But Evidence Says "Yes" (Consumer Federation of America, Consumers Union, Civil Rights Forum, May 30, 2002)

"The Digital Divide Confronts the Telecommunications Act of 1996: Economic Reality versus Public Policy," in Benjamin M. Compaine (Ed.), *The Digital Divide: Facing a Crisis or Creating a Myth?* (Cambridge: MIT Press, 2001)

"The Role Of Technology And Public Policy In Preserving An Open Broadband Internet," *The Policy Implications Of End-To-End,* Stanford Law School, December 1, 2000

"Inequality In The Digital Society: Why The Digital Divide Deserves All The Attention It Gets," *Cardozo Arts and Entertainment Law Journal,* 2002, first presented at Bridging The Digital Divide: Equality In The Information Age, Cardozo School Of Law, November 15, 2000

"Progressive, Democratic Capitalism In The Digital Age," *21st Century Technology and 20th Century Law: Where Do We Go from Here? The Fund for Constitutional Government, Conference on Media, Democracy and the Constitution,* September 27, 2000

"Open Access To The Broadband Internet: Technical And Economic Discrimination In Closed, Proprietary Networks," *University of Colorado Law Review,* Vol. 69, Fall 2000

"Antitrust As Consumer Protection In The New Economy: Lessons From The Microsoft Case, Hastings Law Journal, 52: 4, April 2001, first presented at *Conference On Antitrust Law In The 21st Century Hasting Law School,* February

Evolving Notions of Universal Service (Consumer Federation of America, October 18, 1996) *10, 2000*

Disconnected, Disadvantaged and Disenfranchised (Consumer Federation of America and Consumers Union, October 11, 2000)

Open Access Phase II (Consumer Federation of America, July 13, 2000)

Who Do You Trust? AOL And AT&T … When They Challenge The Cable Monopoly Or AOL And AT&T. When They Become The Cable Monopoly?, (Consumer Federation of America, Consumers Union and Media Access Project, February 2000)

Keeping the Information Superhighway Open for the 21st Century (Consumer Federation of America, December 1999)

Creating Open Access to the Broadband Internet: Overcoming Technical and Economic Discrimination in Closed, Proprietary Network (Consumer Federation of America, December 1999)

Transforming the Information Superhighway into a Private Toll Road: Ma Cable and Baby Bell Efforts to Control the High-Speed Internet (Consumer Federation of America, October 1999)

Transforming the Information Superhighway into a Private Toll Road: The Case Against Closed Access Broadband Internet Systems (Consumer Federation of America and Consumer Action, Sept. 20, 1999)

The Digital Divide (Consumer Federation of America and Consumers Union, February 1999)

Universal Service: An Historical Perspective and Policies for the 21st. Century, Benton Foundation and the Consumer Federation of America, August 1996

"Evolving Concepts of Universal Service," *The Federalist Society,* October 18, 1996

"Protecting the Public Interest in the Transition to Competition in Network Industries," *The Electric Utility Industry in Transition* (Public Utilities Reports, Inc. & the New York State Energy Research and Development Authority, 1994)

The Meaning of the Word Infrastructure, June 30, 1994

"Delivering the Information Age Now," *Telecom Infrastructure: 1993, Telecommunications Reports,* 1993

Consumers with Disabilities in the Information Age: Public Policy for a Technologically Dynamic Market Environment, 1993

Developing the Information Age in the 1990s: A Pragmatic Consumer View, June 8, 1992

Expanding the Information Age for the 1990s: A Pragmatic Consumer Analysis, January 11, 1990

B. The Role of Virtuous Cycles in Innovation and Current Policy Context

The National Broadband Plan (NBP) adopted a "virtuous cycle" view of broadband adoption.[3] The "virtuous cycle" framework posits that innovation and investment at the edge of the network is inextricably linked to innovation and investment in the communications network itself in a recursive, reinforcing feedback loop. Development of applications, devices and content stimulates demand for communications that drives innovation and investment in the supply of communications network capacity and functionality. In turn, improving network functionalities and expanding capacity make new applications possible, which stimulate new demand and the cycle is repeated.

Shortly after the release of the National Broadband Plan, the FCC's Section 706 report concluded that broadband deployment in the U.S. was not "reasonable and timely," triggering the obligation to adopt policies to address the problem.[4] The FCC defined preservation of the Open Internet as one such policy.[5] The D.C. Circuit Court of Appeals upheld the FCC claim of authority, but rejected the specific Open Internet rules.[6] In this proceeding the FCC proposes to adopt an Open Internet order that meets the legal standard the Court has laid down for an order under section 706 and seeks input on other approaches that might be necessary or better suited to achieve the goals of the Act.

The fact that the "virtuous cycle" analysis in the National Broadband Plan has played a prominent role in the Open Internet Order and subsequent litigation should not mislead policy makers, regulators or the courts into thinking that this is the only area where it has an impact and carries weight. The National Broadband Plan is the result of the Congressional desire to have a

---

3 Federal Communications Commission, *Connecting America: The National Broadband Plan,* 2010, p. 15.

4 Sixth Broadband Deployment Report, 25 F.C.C.R. at 9558 ¶ 2.

5 Preserving the Open Internet, GN Docket No. 09-191, WC Docket No. 07-52, Report and Order, 25 FCC Rcd 17905 (2010) (Open Internet Order), aff'd in part, vacated and remanded in part sub nom. Verizon v. FCC, No. 11-1355 (D.C. Cir. Jan. 14, 2014).

6 *Verizon v. FCC*, 740 F.3d 623 (D.C. Cir. 2014)

comprehensive review of the status of deployment and adoption of the leading edge communications technology.[7] The fact that the FCC relied on the "virtuous cycle" to justify the exercise of authority under section 706 does not mean it is irrelevant to other potential authorities. On the contrary, the analysis of the economics of the "virtuous cycle" is generic, providing the basis (justification) for the exercise of any and all authorities that the FCC can claim with respect to broadband policy.

Thus, the concept of the "virtuous cycle" must be the starting point for policy analysis both because it captures the essence of the ongoing economic transformation that is being driven by digital technologies and because it has become a prominent legal foundation for regulatory policy. With the "virtuous cycle" of digital innovation playing an increasingly important role in U.S. communications policy, these comments seek to explain the "virtuous cycle" with reference to several well developed economic literatures including the examination of the development and impact of general purpose technologies, the analysis of innovation systems[8], general theories of the diffusion of innovation, the life cycle of technological revolutions and market success and failure.

C. THE CONSUMER FEDERATION OF AMERICA'S ANALYSIS OF "VIRTUOUS CYCLES"

Early in the Consumer Federation of America's (CFA) analysis presented to the Commission in its reply comments in the National Broadband Plan Notice of Inquiry, we

---

[7] The National Broadband Plan superseded the Steven Report, the congressionally mandated review Congress ordered in Telecommunications Act of 1996 that provided the context for FCC policy for over a decade.

[8] A definition of an innovation system geared to empirical analysis of systems that covers the main features of the system discussed in these comments can be round in Anna Begek, et al., "Analyzing the Dynamics and Functionality of Sectoral Innovation Systems – A Manual, Dynamics of Industry and Innovation: Organizations, Networks and Systems, Copenhagen, 2005:4…8, "the goal of an innovation system is to develop, diffuse and utilize innovations. Taking a system approach implies that there is a system with related components (actors, network, institutions)…. The contribution of a component or set of components to the overall goal is here referred to as a 'function."

introduced the concept of a virtuous circle that is identical to the one the Commission ultimately adopted.

> Recognizing the impact that utilization has on individuals and society leads to the broader concept of digital inclusion. Adoption and use of technology by individuals has benefits at the societal level through network effects and feedback loops creating a virtuous circle of development.[9]

Thus, we are pleased to see the concept take a central role in the economic and legal analysis. CFA did more than just explain the theoretical concept. We introduced a comprehensive review of empirical evidence that supported the concept and showed that the "virtuous cycle" is the correct approach to understanding the policy concerns raised by Congress in the American Recovery and Reinvestment Act (ARRA).

> The empirical evidence overwhelmingly supports Congress' view that maximum utilization of broadband infrastructure can deliver benefits to households and the nation – consumer welfare, economic growth, worker training, civic participation, e-government services, education, training, community development, ability/disability, maximum utilization.[10]

A decade earlier, we used the concept of virtuous circles in the analysis of the digital divide, an issue at the core of the National Broadband Plan and section 706.

> Driven by powerful and unique characteristics of technological revolutions in computing and communications, American society is undergoing a "digital transformation." At the core of the process is a virtuous circle that uniquely affects these industries. Improvements in computers and software can be used to produce further improvement in computers and software. Network effects mean that as more people use these products, the products become more valuable to each user, stimulating more people to join the network and use it more intensely.
>
> The speed and power of change in these technologies has penetrated deeply into the production process of a wide range of industries and transformed the global economy.

[9] Mark Cooper, The Challenge of Digital Exclusion in America: A Review of the Social Science Literature and Its Implications for the U.S. National Broadband Plan, Attachment to "Reply Comments -- National Broadband Plan, Public Notice #30, Center for Media Justice, Consumer Federation of America, Consumers Union, Open Technology Initiative, Public Knowledge, on Broadband Adoption," Federal Communications Commission, In the Matter of A National Broadband Plan for Our Future, GN Docket No. 09-47, 09-51, 09-137, January 27, 2010:11-12.

[10] Cooper, 2010:12.

> The virtuous circle in the economy, however, may become a vicious cycle for those who do not have access to the new technologies.[11]

In these comments CFA restates and refines that long held view of the "virtuous cycle" and brings it to bear on Internet policy in light of the recent developments in the legal terrain. We believe the "virtuous cycle" deserves this attention not only because the FCC used and the courts accepted it, but more importantly, because it is the correct framing for policymaking in the 21st century. Therefore, the regulatory, policy and legal arenas need to build a base of knowledge about how it functions.

The majority in the D. C. Circuit Open Internet ruling endorsed the concept of a "virtuous cycle" and the significant regulatory authority that section 706 grants to the Commission.[12] However, it rejected parts of the FCC specific rules because it concluded that the new authority to regulate broadly to achieve specific goals of the Communications Act could not rely on old approaches to regulation.[13]

At the same time, in his dissent to the Open Internet ruling Judge Silberman complained that the FCC had failed to demonstrate the presence of market power as the basis for a rule that seeks to "control" the market power of the network operators.[14] While the existence or abuse of market power can certainly be a threat to the "virtuous cycle," these comments show that there are many other market barriers, obstacle and impediments that could slow, distort or undermine the "virtuous cycle," including externalities, network effects, spillovers, complementarities, learning, access to capital, transaction costs, etc.[15]

---

[11] Mark Cooper, "Inequality In The Digital Society: Why The Digital Divide Deserves All The Attention It Gets," *Cardozo Arts and Entertainment Law Journal*, 2002, first presented at Bridging The Digital Divide: Equality In The Information Age, Cardozo School Of Law, November 15, 2000:2.

[12] D.C. Cir. 2014: 635-42.

[13] D.C. Cir. 2014:48

[14] D.C. Cir. 2014, Concurring in Part and Dissenting in Part.

[15] D.C. Cir. 2014:41-42, While the majority decision rejects this claim, based on a potential threat to the "virtuous cycle" from the inability of consumers to respond to network owner behavior that would harm the "virtuous

Given this context, a primary task for the FCC in promulgating a new set of Open Internet rules is to design rules that can go as far as possible under the specific grant of 706 authority to achieve the goals of the Act and, where necessary, invoke other sources of authority to exercise powers it needs, but does not have under Section 706. In earlier comments in this proceeding, CFA showed that, whatever else the FCC decides to do, it should embrace the section 706 authority and develop its section 706 powers to the fullest extent possible.[16] The analysis in these comments strongly supports that recommendation. Whatever else the FCC does in the Open Internet Order, a second, equally important, task for the FCC is to have a thorough understanding of the dynamic causes and consequences of Internet innovation system in order to design regulatory instruments that promote the goals of the Communications Act, without harming the "virtuous cycle."

In order to develop a regulatory structure to preserve, extend and strengthen the "virtuous cycle" processes of the Internet innovation system, these comments show that the Commission must understand the dynamic nature of the Internet innovation system at the core of the digital techno-economic paradigm as the most recent phase in the long history of the development of progressive capitalism in the industrial age. The comprehensive, historically grounded framework used in these comments leads to the conclusion that, as the techno-economic paradigm around which society is organized changes, it cannot reach full potential without

---

cycle," these comments show many other sources of harm. "In any event, it seems likely that the reason Verizon never advanced this argument is that the Commission's failure to find market power is not "fatal" to its theory. Broadband providers' ability to impose restrictions on edge providers does not depend on their benefiting from the sort of market concentration that would enable them to impose substantial price increases on end users—which is all the Commission said in declining to make a market power finding. Rather, broadband providers' ability to impose restrictions on edge providers simply depends on end users not being fully responsive to the imposition of such restrictions."

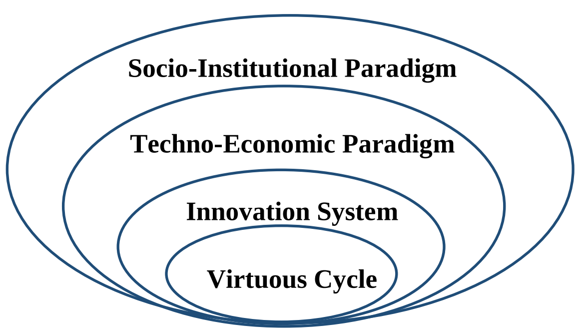
[16] Mark Cooper, Initial Comments of The Consumer Federation of America, *In the Matter of The Open Internet Remand,* Federal Communications Commission, GN Docket No. 14-28, February 25, 2014.

building a socio-organizational paradigm to support, direct and structure it. The effort to write Open Internet rules is an important part of such an undertaking.

Over the course of the 20th century, a huge literature of regulation was built up around the concept of utilities and common carriers. Those were economic concepts that were enshrined in law and justified by analysis because they reflected the economic structure of the age. If we have entered a new economic age in the 21st century, it would not be surprising to find that we need to extend the analytic framework to capture these dramatic changes. As we have argued in comments filed at the FCC in the IP transition proceeding and in law review articles, this economic revolution, just as those before it, requires a not only a new analytic framework but also a new regulatory framework that may borrow some from the old and adapt it to the new economic structure, but above all must add new concepts and tools.

The effort to build that framework in these comments is depicted in Exhibit I-2 as a series of nested layers of analysis. The virtuous cycle emerges from the operation of an innovation system, which is grounded in a techno-economic paradigm that is embedded in a socio-institutional paradigm.

EXHIBIT I-2: THE LAYERS OF ANALYSIS TO EXPLAIN THE VIRTUOUS CYCLE AT THE CORE OF THE INTERNET INNOVATION SYSTEM



All of the layers are important, but the socio- institutional has a uniquely important role.

> Technology is the fuel of the capitalist engine. That technical change should evolve by revolution has only little to do with scientific and technological reasons. It is the mode of absorption and assimilation of *innovations* in the economic and social spheres that requires technical change to occur in coherent and interrelated constellations…
>
> At the turning point, when the system stalls in recession, the state and other institutional, social and economic actors will establish the regulations and other changes in the framework to help launch the deployment period based on the solid expansion of production capital. The institutional sphere is the seat of politics, ideology and of the general mental maps of society… It is also the network of norms, laws, regulations, supervisory entities and the whole structure responsible for social governance.[17]

Because the Internet is the most important resource system in the digital economy, writing rules to preserve the Internet innovation system and the virtuous circle on which it thrives are among the most important socio-institutional undertakings.

D. Outline of the Comment

The virtuous cycle in the digital communications sector will be examined from different points of view in the next four sections.

In Section II we examine the economics of the Internet innovation system, focusing on the factors that have created the powerful "virtuous cycle." In this section we use Shane Greenstein's account of computers and the Internet as General Purpose Technologies as the framing approach. This is the most micro level in the sense that he observes that activity of individuals and firms to extracts principles of economic organization from case studies of three technologies that are directly relevant – computers, Internet and Wi-Fi.

At a higher (meso) level of generalization, in Section III we examine the "virtuous cycle" from more general frameworks. First we use "Innovation Systems" analysis, which is a framework that has been articulated in a sub discipline of the analysis of innovation. Here we describe the core concepts that have been developed to describe (any) set of innovations and then show that digital communications are a particularly powerful Innovative System. At a similar

[17] Carlota Perez, Technological Revolutions and Finance Capital, Edward Edgar, 2002:155-156.

level of generalization we next examine the Internet innovation system from the broad perspective of the literature on the diffusion of innovation. However, having established the powerful, beneficial effects of the virtuous circle from the first two perspectives, we use the general literature on diffusion of innovation to pinpoint the threat to the "virtuous cycle" posed by a policy that allows network owners unregulated to pursuit of their private interests.

In Section IV we consider the Internet innovation system at the core of the digital techno-economic paradigm from a broad theory of technological revolutions. By presenting an analytically rigorous contrast between the techno-economic paradigm of the 20th century, mass market phase of progressive industrial capitalism and the emerging 21st century phase of the Information/telecommunication age paradigm, we lay the basis for understanding the necessary direction for institutional change.

In Section V we examine the Internet innovation system from the point of view of market failure and success. Judge Silberman's focus on market power in his dissent is a useful starting point for the analysis of the "virtuous cycle" not only because it is too narrow, but also because it is actually the wrong way to think about the fundamental processes of the digital revolution. Digital technologies and the dynamic economic process they support need to be viewed positively as providing unique mechanisms to overcome pervasive market barriers and imperfections that afflicted pre-digital industrial technologies and capture positive externalities that have eluded pre-digital techno-economic paradigms.[18] Firms that play an important part in

[18] Cooper, 2013:3-4, framed the analysis of change as follows: "The ultimate objective of the paper is to gain insight into how the governance institutions can **adapt** to the demands of the quarter-life crisis. I choose the word **adapt** purposely, rather than reform, because reform is frequently associated with some sort of failure – "**Reform** means the improvement or amendment of what is wrong, corrupt, unsatisfactory." The characterization grounded in failure does not apply as a general proposition to the Internet and the digital revolution. This is a case where the need for change derives from remarkable success, not failure, because the dramatic growth of the resource system strains its own governance institutions and because the resource system has expanded so rapidly and penetrated so deeply into so many aspects of social life that it is having a huge impact on society. The fact that the driving force for change is a broad pattern of success, rather than failure, does not make it less urgent, but it

the virtuous cycle (provide an important complement to the development and diffusion of innovation) can engage in behavior that is inimical to the "virtuous cycle" in pursuit of their private interests independent of any market power they may or may not possess.

In section VI we review the current legal landscape that has emerged with the rise to prominence of section 706 of the Communications Act, incorporating our earlier comments in this proceeding and adding reflections on two other decisions that bear heavily on the options available to the commission.

In section VII we examine the potential use of Title II authority for the classification of new telecommunications services and the reclassification of broadband Internet access service as a means of filling the gaps that the Section 706 authority leaves.

We have also included a series of Appendices, based on our recent published works that support the main conclusions offered in the body of these comments providing conceptual elaboration and empirical documentation.

Appendix A presents our analysis of the historical development and contemporary importance of six core public service principles that should govern digital communications networks. Recent court cases have made it clear that the FCC has regulatory authority to pursue at least four of the principles, universal service, interconnection, nondiscrimination and innovation at the edge.

Appendix B excerpts our analysis of the successful organization and institutionalization of the Internet as a focal core resource system in the digital techno-economic paradigm. Relying on the works of two Nobel Laureates (Douglas North and Ellinor Ostrom), it present a new

---

does create a somewhat different orientation than reform driven by failure – the challenge of preserving and extending what is working well is prominent, if not paramount."

institutional analysis of the success of the Internet. It also reviews their critique of neoclassical economic analysis.

Appendix C excerpts our analysis of the economic advantages of the digital techno-economic system. It extends the neoclassical dimensions used to describe goods and services – rivalry and excludability – to recognize the economic value of collaboration in the digital economy. Anti-rivalry and inclusiveness becomes sources of value. The study explores three examples, open source, mesh networks and peer-to-peer networks.

Appendix D describes the success of the model based on the unlicensed sharing of spectrum. It documents the remarkable growth of a decentralized innovation system that results when access to a bottleneck resources (spectrum) is made available in an unrestricted manner. It shows that a model based on sharing the resources can yield economic results that equal or exceed the proprietary approach because it provides strong incentive for cooperation, innovation and investment.

Appendix E provides definitions and frameworks that describe the market barriers and imperfections that lead to market success and failure. It bases those definitions on the very long and rich analysis of energy efficiency and the contemporary analysis of challenge of responding to climate change with innovation policy. The energy efficiency and climate change literatures provide a very fertile field of thinking about innovation and market failure for several reasons. First, the traditional of examining market failures in the energy sector stretches back four decades to the oil price shocks of the 1970.   Second, the challenge in climate change is increasingly framed as an innovation challenge, i.e. how to transform energy consuming activities, with inertia of incumbent energy systems a key challenge. Third, the Innovation

Systems literature makes frequent references to it. About two thirds of the market imperfections identified in this literature have been discussed in the analysis of the Internet innovation system.

Appendix F reviews the literature on the diffusion of innovation and relates it to the analysis of market success and failure and of technology revolutions.

Appendix G, presents the analysis of participatory governance. It includes a critique of various forms of alternative regulation and presents principles to promote the success of participatory governance.

II. THE ECONOMICS OF THE DIGITAL REVOLUTION

A. THE TECHNICAL ECONOMIC PARADIGM OF DIGITAL COMMUNICATIONS

Greenstein's framework describes the process of entrepreneurial experimentation at the core of the virtuous cycles that developed in several digital technologies, including computers, the Internet and Wi-Fi. While we frequently hear about positive externalities, spill overs, network effects, feedback loops, etc. that provide powerful economic forces to reinforce the "virtuous cycles," it is important to distinguish the micro level activities in which individuals and firms engage from the macro or system level unintended benefits to which they give rise. At the micro level we can identify a number of conditions that created a space that was extremely friendly to entrepreneurial experimentation, which Greenstein puts at the center of the success of the digital techno-economic paradigm.[19]

The "intentional" activities that constitute the core of the "virtuous cycles" that typify the digital techno-economic paradigm include the following:

- Neutrality of the communications protocols and network devices
- No need to engage in costly bilateral negotiation over the cost and quality of access
- Freedom to experiment
- User driven to an unprecedented degree
- Interoperability
- Open standards
- Importance of platforms
- New relationship to capital markets

The system level characteristics that emerge as positive externalities to reinforce the "virtuous cycle" of the Internet innovation system include the following:

- Expanded division of labor

[19] Shane Greenstein, "Innovative Conduct in computing and Internet Market," *Handbooks in Economic Volume 1,* 2010.

- Divided and diverse technical platform leadership
- Specialization of supply firms
- Network effects
- Knowledge flows
- Learning externalities

Greenstein singles out two critical features that enabled the micro level activity that gave rise to an explosion of entrepreneurial experimentation.

> There were many new features to the commercial Internet, but two features especially stood out as a type of commercial computing network technology. First, the Internet was designed to have its intelligence at the end of the network. That is, users had to adopt applications in the PCs and workstations that were compatible with one another, but did not have to worry about any of the devices or protocols inside the network.
>
> Second, once the commercial Internet had diffused (by 1997 to all major cities in the United States), a remarkable set of new possibilities emerged: The Internet made it possible for users and vendors to move data across vast geographic distances without much cost, either in operational costs and/or in advanced set-up costs of making arrangements for transport of data. Together, those two features enabled enormous combinations of users and suppliers of data that previously would have required bilateral—and, therefore, prohibitively costly—agreements to arrange. In brief, it enabled a network effect where none had previously existed, involving participants who could not have previously considered it viable to participate in such a network.[20]

The fact that users and companies at the edge did not have to "worry about" the devices and protocols inside the network" and could use the ubiquitous telecommunications network without bilateral – and prohibitively costly – arrangements" were essential and necessary features of a communications environment that fostered innovation at the edge. The arrangement involved the dramatic reduction in transaction costs that created a network effect. "Network neutrality" is a perfect description for a situation in which you do not have to "worry about" the insides of the network or negotiate to make agreements for transport of data through the network.

In addition to being freed from having to "worry about" the inside of the network and not having to negotiate bilateral agreement, Greenstein points out that the Internet protocol itself was

[20] Greenstein, 2010:489-490.

managed as an open standard subject to an multi-stakeholder governance process. This prevented the incumbent telecommunications companies from hijacking the standard setting process.

> Some observers attributed the rapid accumulation of experimentation to the emergence of a new form of leadership for designing standards, one that involved collections of market participants. The standards committees that were responsible for designing key standards for the Internet were comprised of representatives from many firms and interested researchers from universities and other nonprofit organizations. Because undirected economic experiments are those undertaken by more than one firm working together, by definition, the committees participated in these types of experiments. This raised the profile of activities inside standards committees and it directed attention at different forms of consensus-oriented standards processes for designing standards accommodating a variety of complementary goods and services.
>
> Ultimately, the accumulation of Internet industry knowledge depended on spreading the lessons learned from economic experiments. Further innovations then built on that knowledge, renewing a cycle of accumulated lessons from more experiments. This accumulation was a key driver of the market's evolution because it set the conditions for innovative behavior. Standards committees participated in this cycle and helped shape the Internet by affecting, for example, pricing, the quality of services, and the identity of leading firms.
>
> Standards committees had always played some role in the computer market. Their role in the Internet was more notable for what it was not: These institutions were not beholden to the managerial auspices of AT&T or IBM. For that matter, these committees also did not simply ratify the design decisions of Intel, Microsoft, or Cisco, though all those firms sent representatives who had a voice in shaping outcomes.
>
> The range of such important decisions shaped by standards committee was without precedent. The IEEE, for example, made designs that shaped the LAN market, modem, and wireless data communications markets, while the IETF made designs that shaped the operations of every piece of equipment using TCP/IP standards. Many of these decisions went into use quickly, ensured that all complying components would interoperate, and had enormous consequences for the proprietary interests of firms.
>
> Never before had such a large industry had so much of its innovative activity shaped by collective firm decisions.[21]

In the array of potential sources of information, the new paradigm provides the opportunity for the most edgy of all actors – consumers and users – to play a much larger role in driving innovation. "All of the sources of ideas for new R&D projects outside the R&D lab itself,

[21] Greenstein, 2010:517.

including suppliers, rivals, university and government labs or even a firm's own manufacturing operations, customers are far and away the most important. [22]

Malerba provides an elaborate discussion of the impact of demand in the computer sector, emphasizing not only the important role it plays, but also the imperfections in consumer behavior.

> One could just start by noticing that in several industries demand has been a major factor affecting industrial dynamics and innovation. In semiconductors and computers, public demand such as military procurement has been important for innovation in the early stages of the industries. In computers experimental customers have been major actors in the emergent phase of the industry. In information technology users' involvement has been key for the development and modification of standards.
>
> Demand has also been related to the emergence of disruptive technologies. Here the early development of disruptive technologies serves niche segments that value highly their non standard performance attributes. Further developments in the performance and attributes of disruptive technologies lead these technologies to a level sufficient to satisfy mainstream customers.
>
> Consumer behaviour plays a major role in affecting innovation. It includes the presence of information asymmetries and imperfect information with respect to new products and technologies as well as routines, inertia and habits concerning existing products and technologies. Also consumer capabilities influence technological change in an industry: as an example one could only mention the role of absorptive capabilities and their distribution among consumers and users.
>
> The focus on the behaviour and capabilities of consumers and users opens the way for a very productive analysis of how demand affects innovation and the specific patterns of industrial dynamics. In this respect let me mention some fruitful directions. One relates to users involvement in innovation. This is a quite common phenomenon in industries. It may range from user-producer interaction to user initiated innovation. Users' involvement in innovation may represent more than simple participation to the innovation process, and may regard learning and knowledge exchanges between the user and the producer.
>
> [F]or IT, co-invention involves the technology of the user as well as the one of the supplier. Users' co-inventions are particularly important in explaining technological change in IT applications (package software, semi-custom IT solutions, turn-key solutions). Co-invention pulls technological change in a variety of directions and ways. This means that in IT there is not "one" standard type of adoption. Rather, co-inventions in IT and its applications represent developments in tightly coupled interconnected technologies. Co-inventions generate new trajectories of improvements in the original

[22] Wesley M. Cohen, "Fifty Years of Empirical Studies of Innovative Activity and Performance," *Handbooks in Economic Volume 1*, 2010:172.

> technology, new organizational change and new institutions, which in turn generate new co-inventions between users and suppliers.[23]

The impact of the micro level intended or directed activities described above were reinforced by undirected processes. There were strong positive external economies associated with the emerging techno-economic paradigm. These are widely referred to as "dynamic increasing returns… self-reinforcing, positive feedback cycles. Other external economies among users, increasing returns to learning and development of expertise, the nonrivalrous character of application of innovation to output, innovational complementarities, spillover pools.[24]

Thus, the "virtuous cycle" is a draws on the "technical-economic-paradigm" and the "institutional structure" that supports it. The technical economic paradigm thrives on entrepreneurial experimentation, while the institutional structure is based on a variety of planned and unplanned collaborative undertakings (platforms, standards, open protocols, and an ecology of outsourcing components). The collaborative undertakings involve actions that are intended to facilitate the entrepreneurial experimentation at the core of the new technical economic paradigm. The positive externalities created by an environment in which information flowed freely was a powerful unintended consequence of the development of the new paradigm.

> As noted below in our consideration of technological opportunity, to link these different sources of dynamic increasing returns to innovation and market structure, one might usefully distinguish among the sources on the basis of the degree to which they are tied to specific firms (e.g., learning by doing, or R&D fixed cost spreading), versus those which are tied to technologies that can potentially stand apart from the firms that may have first introduced them (e.g., network externalities or learning by using). In this latter case, the nature of the innovation, and possibly its complementarity with other technologies, will tend to drive market structure rather than the reverse.[25]

[23] Franco Malerba, *Industrial Dynamics and Innovation: Progress and Challenges,* Presidential Address, Conference of the European Association for Research in Industrial Economics, September, 2005:7, 8, 10, 11.
[24] Cohen 2010:177-181.
[25] Cohen, 2010:158.

The new environment allows the division of labor, long recognized as an essential component of increasing productivity, to be carried to a level not previously achieved.[26] The environment created by experimentation deconcentrates markets.[27] The relationship between innovators and financial markets also change, if for no other reason than the scale and diverse scope of activities.[28]

This new techno-economic paradigm dramatically improves economic performance because it facilitates economic activity at the micro level that had been hampered by traditional market barriers or imperfections (transaction costs, access to capital, market power, etc.) and has the effect of reducing a number of other market imperfections that had hampered the macro level performance of the system (provision of public goods, learning, spillovers, network effects, etc.)

B. The Key Role of Government

[26] Greenstein, 2010: 488, The specialization of supply frames one of the distinctive strategic issues of the modern era. Firms with quite different capabilities, specializing in one or a small set of components, cooperate with others at the boundary of their respective firms. In personal computing, for example, an array of distinct firms arose that specialized in supplying different parts of the PC (e.g., many firms provided the electronic components), while different firms provided the software. An entirely different set distributed the final product and became involved in servicing it. The benefits of allowing users to mix and match components and service outweighed most of the benefits of coordinating production entirely inside one firm.

[27] Greenstein, 2010: 480, Innovative conduct related to the commercial Internet did give rise to platforms, but it also gave rise to markets characterized by an extraordinarily high division of technical leadership. In turn, that resulted in an unprecedented dispersion of uncoordinated innovative conduct across a wide range of components affiliated with the Internet; Commercial Internet markets involve new organizational forms for coordinating firms with disparate commercial interests, such as open source platforms. Their presence and successful operation accounts for some salient unanticipated innovative conduct; The aspirations of entrepreneurs and incumbent firms in commercial Internet markets touched an extraordinarily large breadth of economic activity;
Shane Greenstein, "”Economic Experiments and Neutrality in Internet Access," *Innovation Policy and the Economy*, (8) 2007:59…61, Highlighting economic experiments, in contrast, emphasizes how the environment allowed for a range of alternative commercialization strategies in terms of pricing structures, marketing strategies, and the like when market participants had choices among several options. This provided great leeway for a diversity of commercial outcomes.

[28] Greenstein, 2010: 512, With the Internet, the relationship between the investor community and entrepreneurial community took a different scale and pace than it had in prior technology-induced waves, such as with PCs, LANs, and client–server systems. In part, this was due to the breadth of perceived opportunities. Rather than being a brief race among several dozen firms to develop new components and related systems, the Internet invited a wide range of new thinking across many activities—in back-office computing, home computing, and information retrieval activities in numerous information-intensive industries, such as finance, warehousing logistics, news, entertainment, and more.

Greenstein's analysis cited above does not examine how the network neutrality that existed on the eve of the explosion of the commercial Internet and was so vital to its success came into existence. Tim Wu (among many others), has identified a series of regulatory decisions that paved the way.

> [T]he FCC ordered Bell to allow the connection of the "Carterphone," a device designed to connect a mobile radio to a Bell Telephone… the FCC went further and specified something simple but absolutely essential: the familiar RJ-45 telephone jack… The modular jack made it unnecessary for a Bell technician to come and attached one's phone to the phone line. More crucial, with the phone change in place, any innovator – any person at all – was suddenly free to invent things that could be usefully attached to the phone lines…
>
> They also made possible the career of Dennis Hayes, a computer hobbyist ("geek" is the term of art) who, in 1977 built the first modulator/demodulator (modem) designed and priced for consumers, the so-called Hayes Modem…
>
> [T]he FCC issued a rule banning AT&T from directly entering the market of "data processing" or "online services." These were the earliest precursors of what we now call Internet service…
>
> In short, with strange and unprecedented foresight, the FCC watered, fertilized, and cultivated online computer services as a special, protected industry, and, over the years, ordained a set of rules called the *Computer Inquiries,* a complex regime designed both to prevent AT&T from destroying any budding firms and also to ensure that online computer service flourished unregulated.[29]

Francois Bar notes that the FCC made a number of additional decisions that magnified the importance of the commitment to access to the core communications network and the decision not to regulate behavior in the data transmission area.

> The FCC allowed specialized providers of data services, including Internet Service Providers (ISPs) and their customers, access to raw network transmission capacity through leased lines on cost-effective terms. Regulatory policy forced open access to networks whose monopoly owners tried to keep them from using the full capabilities of the network in the most open and free manner.
>
> Thanks to the enduring FCC policy of openness and competition, specialized networks and their users could unleash the Internet revolution. Open network policy assured the widest possible user choice and the greatest opportunities for users to interact with the myriad of emerging new entrants in all segments of the network. To be sure, the FCC strategy emerged haltingly but its direction never changed. Indeed, the Commission

[29] Tim Wu, *The Master Switch,* Knopf, 2010:190-191.

> consistently back cost-based access to the network (initially through leased lines and later through unbundled network elements). The de facto result of this policy, and of more conscious choices symbolized by the *Computer III* policies, was to prevent phone company monopolies from dictating the architecture of new data-related services. The Commission thus supported competition and innovation, time and again, by unfailingly keeping the critical network infrastructure open to new architectures and available to new services on cost-effective terms. The instruments of FCC policy were to make leased lines (and, lately, network elements) available on cost-oriented terms and to forebear from regulating Internet and other data services. This steady policy set in motion, and sustained, a virtuous cycle of cumulative innovation, new services infrastructure development, increasing network usage with evident economic benefit for the U.S. economy.[30]

Thus, this was not a one-off policy, but a sustained commitment. In this context, the adjectives "strange and unprecedented" used by Wu seem inappropriate to refer to the FCC foresight that paved the way for the Internet protocols to trigger the growth of the new communications economy. In fact, they were not unique. The FCC repeated the feat in helping to create the conditions for the explosive growth of another communications protocol, Wi-Fi. Here, Greenstein acknowledges the role of the FCC.

> More surprising, a wireless fidelity technology now popularly known as Wi-Fi became dominant. Wi-Fi did not arise from a single firm's innovative experiment. Rather, Wi-Fi began as something different that evolved through economic experiments at many firms. The evolution arose from the interplay of strategic behavior, coordinated action among designers, deliberate investment strategies, learning externalities across firms, and a measure of simple and plain good fortune….
>
> Federal spectrum policy cooperated with these technical initiatives indeed, nothing would have succeeded in its absence. The Federal Communications Commission (FCC) holds authority to license or bar companies from using spectrum. In late April of 1996, after several groups had begun discussing designs, the FCC initiated a "Notice for Proposed Rule Making" to make available unlicensed spectrum for what became known as Unlicensed National Information Infrastructure (U-NII) devices.
>
> Events then took on a momentum all their own. Technical successes became widely publicized. Numerous businesses began directed experiments supporting what became known as hot spots, which was another innovative idea….
>
> A hot spot was a use far outside the original motivation for the standard. Yet because nothing precluded this unanticipated use from growing, grow it did… The growing use

[30] Francois Bar,et. al., *defending the Internet Revolution in the Broadband Era: When Doing Nothing is Doing Harm,* Working Paper, Berkeley Roundtable on the International Economy (BRIE), August 1999, cited in Cooper, 2002:68-69.

> of Wi-Fi raised numerous unexpected technical issues about interference, privacy, and rights to signals. Nevertheless, they did not slow Wi-Fi's growing popularity Web sites sprouted up to give users, especially travelers, directions to the nearest hot spot. As demand grew, suppliers gladly met it. As in a classic network bandwagon, the growing number of users attracted more suppliers and vice versa.[31]

Again a federal regulatory decision created access to a communications space but did not regulate activity within the space. The unfettered experimentation made possible by that decision combines with the recognition of the need for an accessible standards to create a powerful network effect. Thus, FCC action embodies an enigma and resolves an inherent contradiction – sharp regulatory action is necessary to create a space for individual entrepreneurship, but freedom from regulation to conduct entrepreneurial experiments in that space.

There were a host of other widely recognized ways in which the public policy supported the development of the digital techno-economic paradigm. These included, to name just a few, the development of the Internet protocol at the request and with the funding of the Department of Defense and the role of a quasi-governmental agency in the early years in the management of the network of networks, while norms were being developed, and the development of a browser.[32]

[31] Greenstein, 2007:69… 70…71.
[32] Greenstein, 2010:508, 509.

III. INNOVATION AND ITS DIFFUSION

The study of innovation has received a great deal of attention in the past several decades as it came to be recognized that innovation plays a large part in determining the speed and direction of economic growth. From the residual in the estimation of production functions, it has become the centerpiece of analysis and policy. This section brings insights from two of the most prominent innovation literatures to bear on the issue of the "virtuous cycle" at the heart of the Internet innovation system and the digital techno-economic paradigm.

A. INNOVATION SYSTEMS

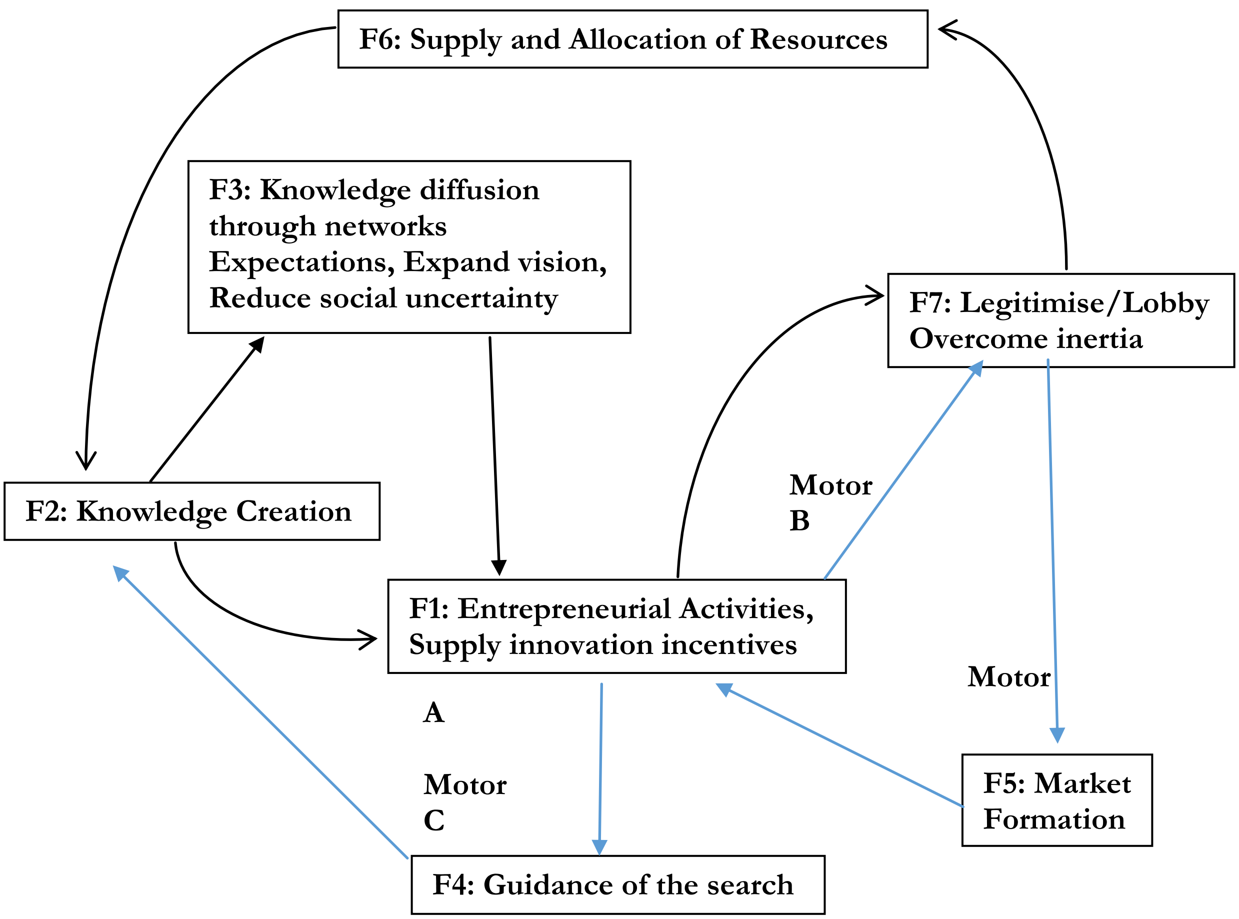
One approach that has received a lot of attention is the analysis of "innovation systems," which takes an institutional and evolutionary view of technological change.

> The NSI [National System of Innovation] concept represented for policymakers an alternative to industrial policies, while at the same time providing strong support for the role of public authorities in creating the "right" institutional conditions for a knowledge-driven economy to flourish….
>
> The central idea in modern innovation systems theory is the notion that what appears as innovation at the aggregate level is in fact the result of an interactive process that involves many actors at the micro level, and that next to market forces many of these interactions are governed by nonmarket institutions. Because the efficiency of this process observed at the macro level depends on the behavior of individual actors, and the institutions that govern their interaction, coordination problems arise… Not surprisingly, economists in the institutional tradition of innovation studies and scholars of evolutionary theories became the strongest proponents of the notion of systems of innovation. In these views the system of innovation is a continuous process where institutions (habits and practices), learning, and networks play a central role in generating innovation and technological change…
>
> the innovation systems literature has led to five main insights: the importance of a broader set of innovation inputs than just R&D, the importance of institutions and organizations, the role of interactive learning, leading to a dynamic perspective rather than a static allocative one, the role of interaction between agents, and, finally, the role of social capital. Each one of those specific points opens up links with literatures and approaches that are not so common in (mainstream) economics.[33]

[33] Luc Soete, Bart Verspagen and Bas Ter Weel, "Systems of Innovation," *Handbooks in Economic,* Volume 1:1163…1177).

The innovation systems approach defines the system as a series of interrelated functions that determine the speed and nature of innovation (see Exhibit III-1). Entrepreneurial activity (experimentation) is at the center of the system (with six linkages). Knowledge creation is the next most important node in the system (with four linkages).

EXHIBIT III-1: FUNCTIONS AND MOTORS FOR VIRTUOUS CYCLES IN THE INNOVATION SYSTEM



Source: M.P. Hekkert, et al., "Functions of innovation systems; A new approach for analyzing technological change," ***Technological Forecasting & Social Change,*** **(4) 2007:426.**

"Virtuous cycles" play a prominent role in the analysis.

> A common trigger for virtuous cycles… is guidance of the search. In this case societal problems are identified and government goals are set… These goals lead to new resources, which, in turn, lead to knowledge development and increasing expectations about technological options. (Motor C)

> Another possible start for virtuous cycles are entrepreneurs who lobby for better economic conditions to make further technology development possible (function 7: counteract resistance to change). They either lobby for more resources to perform R&D which may leaded to higher expectations (Motor B), or they lobby for market formation since very often a level playing field is not present (Motor A). When markets are created, a boost in entrepreneurial activities (F1) is often visible leading to more knowledge formation (F2), more experimentation (F1), and increase lobby (F7) for even better conditions and high expectations [F3] that guide further research (F4).[34]

The description of the Internet offered by Greenstein can be interpreted as an innovation system that produces powerful and unique innovation activities.

- Entrepreneurial activity. Greenstein identifies this as entrepreneurial experimentation, a uniquely innovative approach to activity.
- Market formation. In the case of the Internet this should be more broadly defined as the creation of a transaction space, since non-market, collaborative exchanges play such an important part in the Internet's virtuous cycle.
- Knowledge creation and exchange is greatly facilitated by collaborative production and the clustering of activity in specific locations.
- Diversified platform leadership enhanced the guidance of search.
- Decentralization facilitated the supply of resources.

Malerba offers general principles for system analysis that he extracts (demonstrates) with the description of specific sectors. His account of the innovation system in the telecommunications and information sector notes many of the attributes discussed above and highlights the difference between 20th century telecommunication and 21st century digital communications.

> In telecommunications equipment and services, the knowledge base has been quite diversified because the sectoral system encompasses fixed communications, mobile phones, internet and other services. All these product groups present different features, but they are related technologies in some way or another. Moreover, this broad sectoral system has been recently affected by processes of convergence between information and communication technologies and between ICT and broadcasting-audio-visual technologies. Until the advent of the internet, the telecom service industry did not experience major technological and market discontinuities. With the internet and its

[34] M.P. Hekkert, et al., "Functions of innovation systems; A new approach for analyzing technological change," Technological Forecasting & Social Change, (4) 2007:426.

open network architecture, modular components and distributed intelligence, both the knowledge base and the types of actors and competencies have changed significantly.

> The process of convergence has generated the entry of several new actors coming from various previously separated industries, each one emphasizing different sets of competencies…
>
> Specialised competencies and specific knowledge have increasingly become a key asset for firms survival and growth. Even more important in the new telecom environment is the combination of existing and new competencies – software programming, network. Networks among a variety of actors (not only firms, but also standard-setting organisations and research organisations) are relevant. Demand plays a key role in innovation not just in terms of user–producer interaction, but also in terms of emerging characteristics. This is particularly true in the internet services sector, where the changing requirements of the final users – from standardised services like internet access and e-mails, to more complex applications such as intranets, extranets and platforms for electronic commerce – have stimulated firms to upgrade the quality of services.
>
> Regulation, liberalisation/privatisation and standards have played a key role in the organization and performance of the sector. They had major effects on the behaviour of incumbents and have transformed the structure of the industry.
>
> The knowledge base has changed over time and has affected the boundaries and structure of sectoral systems. In general, in several sectors a rich, multidisciplinary and multi-source knowledge base and a rapid technological change have implied a great heterogeneity of actors. In addition to firms within a sector, some actors have proven particularly important for innovation. In particular, suppliers and users have become relevant in the organisation of innovative activities. Suppliers and users have also affected the boundaries of sectoral systems by greatly affecting sectoral linkages and interdependencies. Demand has often proven important in several respects: a major cause in the redefinition of the boundaries of a sectoral system; a stimulus for innovation and a factor shaping the organisation of innovative and production activities. In addition, the emergence of new demand or the transformation of existing demand has been one of the major elements of change in sectoral systems over time. [35]

Malerba identifies a number of characteristics that will result in a more specialized division of labor and a more fragmented sector. The digital techno-economic paradigm exhibits all of these characteristics, "a heterogeneous demand…competing technologies with lock-ins… network externalities and standards.[36]

[35] Malerba, 2005:72-73…75.
[36] Malerba, 2005:77.

B. THE INNOVATION DIFFUSION LITERATURE

The general literature on the diffusion of innovation strongly supports the above characterization of the Internet innovation system at the heart of the digital techno-economic paradigm. Given its broader sweep and detailed analysis of a wide range of technologies, it provides a strong basis for examining the obverse of the public policy question confronting the FCC. We have shown that the innovation system of digital techno-economic paradigm exhibit a unique combination of characteristics that creates a very dynamic innovation environment. We have also shown that policy decision by the FCC that controlled the behavior of the incumbent communications network owners played an important part in making that environment possible. Would a decision to remove those constraints allow the communications network owners to engage in behaviors that would harm that environment? A review of the general diffusion literature suggests that there are a number of actions by incumbent communications network owners that they would pose significant threat. These reasons go far beyond the concern about market power.

To begin the analysis, we must recall the nature of the network owners. They are the large, bureaucratically organized incumbents that dominated the 20th century communications networks in both voice and video. The communications function remains important in the 21st century digital ecology and the Internet platform. Given their location and importance in the digital communications platform, left unregulated to pursue their interest they are likely to do significant harm to freedom of entrepreneurial experimentation at the edge of the network that is the driving force in the "virtuous cycle."

- Their actions can dampening the willingness and ability of the edge to experiment:
  - imposing counterproductive "worry" about the network and its devices,

- increasing costs substantially by forcing edge entrepreneurs to engage in bilateral negotiation,
  - undermining interoperability, and
  - chilling innovation through the threat of "hold up" of successful edge activities.
- As incumbents they have a conservative, myopic bias, and are certain to be far less innovative and dynamic than the edge based on a
  - preference for preserving the old structure,
  - pursuit of incremental, process innovation rather than radical, product innovation, and
  - proprietary culture that prefers restrictions on the flow of knowledge.
- Competition is much weaker in the network segment of the digital platform than in the edge segments, which means network owners
  - face less pressure to innovate,
  - have the ability to influence industrial structure to favor their interests at the expense of the public interest,
  - can use vertical leverage (where they are integrated) to gain competitive advantage over independent edge entrepreneurs, and
  - have the ability to extract rents, where they possess market power or where switching costs are high.

That many of these concerns are forward looking should not be surprising, since it is the opportunity to experiment (in the face of the unpredictability of success and failure) that is the most valuable trait of the Internet innovation system. The Communications Act is very much a forward looking statute, regulating behavior to achieve goals and prevent harms, rather than correcting harms after the fact.[37]

At the same time, the network operators have given strong indication that they have the incentive and ability to engage in these antisocial kinds of conduct. Services that compete with the franchise offerings of network owners, voice and video have been singled out for attack.

- **Blocking:**
  - Madison River blocking VoIP ports (2005):
  - Cingular's blocking of Paypal (2006):
  - AT&T blocking of Slingbox iPhone application (2010):
  - Skype blocking on mobile networks (2010):
  - FaceTime blocking over mobile devices unless using Mobile Share plan (2012):

[37] Unlike the antitrust laws that are generally backward looking, with the notable exception merger review.

- Verizon blocking access to tethering apps (2012):

- **Degradation:**
  - Comcast degrading Bittorrent Traffic (2007):
  - Netflix degradation on Comcast (2013-2014)
  - Comcast refusal to connect Netflix CDN (2013)
- **Discrimination:**
  - Comcast exemption of Xfinity online video app on Xbox and TiVo from data caps (2012)
  - AT&T sponsored data plan on wireless network (2014)
  - T-mobile “Music Freedom” exemption of popular music streaming sites from data caps (2014):
- **Raising rivals’ costs:**
  - Comcast/Verizon interconnection agreements with Netflix (2014):
  - Continuing problems with wireless data roaming (2010-2014)

These are all broadband era behaviors, the recent examples of a decade long game of cat and mouse with the network owners. The early rounds of debate in the period before the cable modem order revealed behaviors that would be devastating to innovation and competition.

> A term sheet offered by Time Warner to unaffiliated ISPs who had requested access to its network during the summer of 200 gives a new and troubling specificity to the threat to innovation. There in black and white are all the levers of market power and network control that stand to stifle innovation on the Internet. Time Warner demanded the following:
>
> 1. Prequalification of ISPs to ensure a fit with the gatekeeper business model
> 2. Applying ISP must reveal sensitive commercial information as a precondition to negotiation
> 3. Restriction of interconnecting companies to Internet access sales only, precluding a range of other intermediary services and function provided by ISP to the public (e.g. no ITV[interactive TV] functionality)
> 4. Restriction of service to specified appliances (retarding competition for video services)
> 5. Control of quality by the network owner for potentially competing video services
> 6. Right to approve new functionalities for video services
> 7. A large nonrefundable deposit that would keep small ISPs off the network

8. A minimum size requirement that would screen out niche ISPs
9. Approval by the network owner of the unaffiliated ISPs home page
10. Preferential location of network owner advertising on all home pages
11. Claim by the network owner to all information generated by the ISP
12. Demand for a huge share of both subscription and ancillary revenues
13. Preferential bundling of services and control of cross market of services
14. Applying ISP must adhere to the network operator's privacy policy

> Under these conditions, the commercial space left for the unaffiliated and small ISPs (where much innovation takes place) is sparse and ever shrinking.[38]

AT&T's negotiations with Mindspring exhibited similar problems.[39]

Extending the time horizon farther into the past would strongly support the concern about the incentive and ability to drive the system away from the decentralized freedom to innovate, including opposition to the most fundamental policy decision (Carterphone and the Computer Inquiries). At every step along the trajectory of AT&T's hostility to a decentralized communications protocol, its opposition to allowing the freedom to attach "foreign exchange equipment" to the network, the obligation to afford data nondiscriminatory access to the telecommunications network. It scoffed at the idea of decentralized communications protocol. Thus, the conceptual clarity of the threat and the record of past behavior suggests that the Commission has a strong evidentiary basis to take measures to prevent harmful behavior by network owners.

The traditional concerns about market power abused by large incumbents has received a great deal of attention, too much in the sense that the other sources of market failure that would undermine or weaken the "virtuous cycle" deserve at least as much attention. The fundamental

[38] Northnet, Inc., "An Open Access Business Model for Cable Systems: Promoting Competition & Preserving Internet Innovation on A Shared, Broadband Communications Network, Ex parte, Application of America online Inc., & Time Warner, Inc. for Transfer of Control, FCC, CS Docket No. 00-30, October 16, 2000, cited in Mark Cooper, *Open Architecture as Communications Policy,* Stanford Law School, Center for Internet and Society, 2004:168-169.

[39] See Mark Cooper, "Open Access To The Broadband Internet: Technical And Economic Discrimination In Closed, Proprietary Networks," *University of Colorado Law Review,* Vol. 69, Fall 2000 :1037.

point is that “[l]eading incumbent firms and new entrants face different incentives to innovate when innovation reinforces or alters market structure.”[40] The incumbents ill invest in innovation that supports the platform and their leading role in it. [41] In particular, they will prefer proprietary standards.[42]

> If one assumes—and this is a strong assumption—that technological diversity (e.g., the variety of approaches adopted to address a technological challenge) both promotes technical advance and is associated with a larger number of firms within an industry, then… larger firm size may come at the cost of the benefits of technological diversity.[43]

> In all these examples, no single firm initiated an economic experiment that altered the state of knowledge about how to best operate equipment or perform a service. Rather, many firms responded to localized user demand, demonstrations of new applications, tangible market experience, vendor reaction to new market situations, and other events that they could not forecast but which yielded useful insights about the most efficient business actions for generating value.[44]

Nevertheless, while traditional concerns about pricing abuse are raised, there is a recognition in the literature of the barrier to entry and the threat to experimentation that network owner market power may pose.

---

[40] Greenstein, 2010: 479.

[41] Cohen, 2010:137-138…139. In short, platform leaders have incentives to expand the scope of platforms from which they profit, and they have incentives to aspire to continuity in the use of that platform. Entrants, in contrast have incentives to consider whether to commit to an existing platform, or to join another that might compete with it. In turn, that translates into high incentives for incumbents to support design of new proprietary standards for an existing platform, but not nonproprietary standards that might lead to more competition between platforms. On the other hand, entrants of applications prefer to make them compatible with as many platforms as possible, which leads to incentives to work toward non-proprietary standards, or other technological tools to reduce the cost of supporting cross-platform applications…. As a result, the nature of the innovation the large incumbents firms pursue will be different. The key findings are that larger, incumbent firms tend to pursue relatively more incremental and relatively more process innovation than smaller firms. Whether new ventures and entrants (as opposed to small firms more generally) are chiefly responsible for “radical” innovation—though often talked about—suffers from a dearth of rigorous empirical study. One exception is provide evidence from the personal computer software industry that new firms tend to create new software categories, while established firms tend to develop improvements in existing categories… some have argued that smaller firms, especially new ventures, are more capable of innovating than larger firms or, similarly, are more capable of spawning more significant or distinctive innovations than larger incumbents…the share of R&D dedicated to process innovation indeed rises with firm size. And the implication that larger firms pursue relatively more incremental innovation is consistent with previously cited findings.

[42] Greenstein, 2010: 492-493, that translates into high incentives for incumbents to support design of new proprietary standards for an existing platform, but not nonproprietary standards that might lead to more competition between platforms. On the other hand, entrants of applications prefer to make them compatible with as many platforms as possible, which lead to incentives to work toward nonproprietary standards, or other technological tools to reduce the costs of supporting cross-platform applications.

[43] Cohen, 2010:154.

[44] Greenstein, 2010:500-501.

> The flow of events during more recent experience has also depended on the choice made by incumbent firms…
>
> In each platform, it is rare to observe more than a small number of firms acquiring leadership positions. It is unsurprising, then, that questions about how incumbent firms react to new entry and defend existing positions in valuable markets have attracted antitrust scrutiny.[45]

Greenstein identifies many anticompetitive concerns with vertical integration concerns. That is network owners take action to gain an advantage in the competition for complements.

> This concern borrows themes from the prior analysis of mixed incentives. After signing deals with content providers, a carrier has an incentive to protect its own commercial interests and directed experiments, pricing in a way to disadvantage other potential providers of new Internet applications. In other words, a carrier takes the position as a complement in production to someone else's service that potentially substitutes for a service they or a business partner provide. Carriers also can choose to enter service markets where they can use their discretion to disadvantage a potential competitor. (93)
>
> First, a carrier can use preinnovation contracting to generate market conditions that limit entry of innovative content providers. Second, carriers can use post innovation bargaining to strategically aid their competitive position. There are a variety of reasons why both of these are a general concern because the carriers may intend to imitate content providers, may intend to compete through provision of their own service, or may intend to compete with alliance with another content provider. And there are a variety of ways for a carrier to take such action. (94)

Moreover, there is no reason to dismiss the possibility that simple rent seeking, distinct from vertical leverage, as a concern, since this will slow adoption and weaken the "virtuous cycle."[46]

IV. THE TECHNOLOGY REVOLUTIONS OF PROGRESSIVE CAPITALISM IN THE INDUSTRIAL AGE

Carlota Perez has offered a high level theory of technology revolutions that seeks to find regularities in the development of the economic structure and social institutions that govern it.[47]

---

[45] Greenstein, 2010:497

[46] Bronwyn H. Hall, "Innovation and Diffusion," In Fagerberg, J., D. Mowery, and R. R. Nelson (eds.), *Handbook of Innovation*, Oxford University Press, 2004, page reference to October 8, 2003:28. Highly concentrated providers of new technology will tend to have higher prices, slowing adoption. Paul Stoneman and Giuliani Sattisti, "The Diffusion of New Technology," *Handbooks in Economic Volume 1*, 2010:747\, The more competitive an industry the nearer are its prices likely to approximate marginal costs and thus its profits approach zero… The lower are costs, *ceteris paribus* lower are prices going to be. The lower are prices the greater will be the extent of diffusion at any point in time. In addition, the faster costs fall the faster prices are likely to fall.

The analytic structure describes the progress of capitalist development through five phases of the industrial revolution, with the current phase identified as the Age of Information and Telecommunications.

A. PHASES OF TECHNOLOGICAL REVOLUTIONS

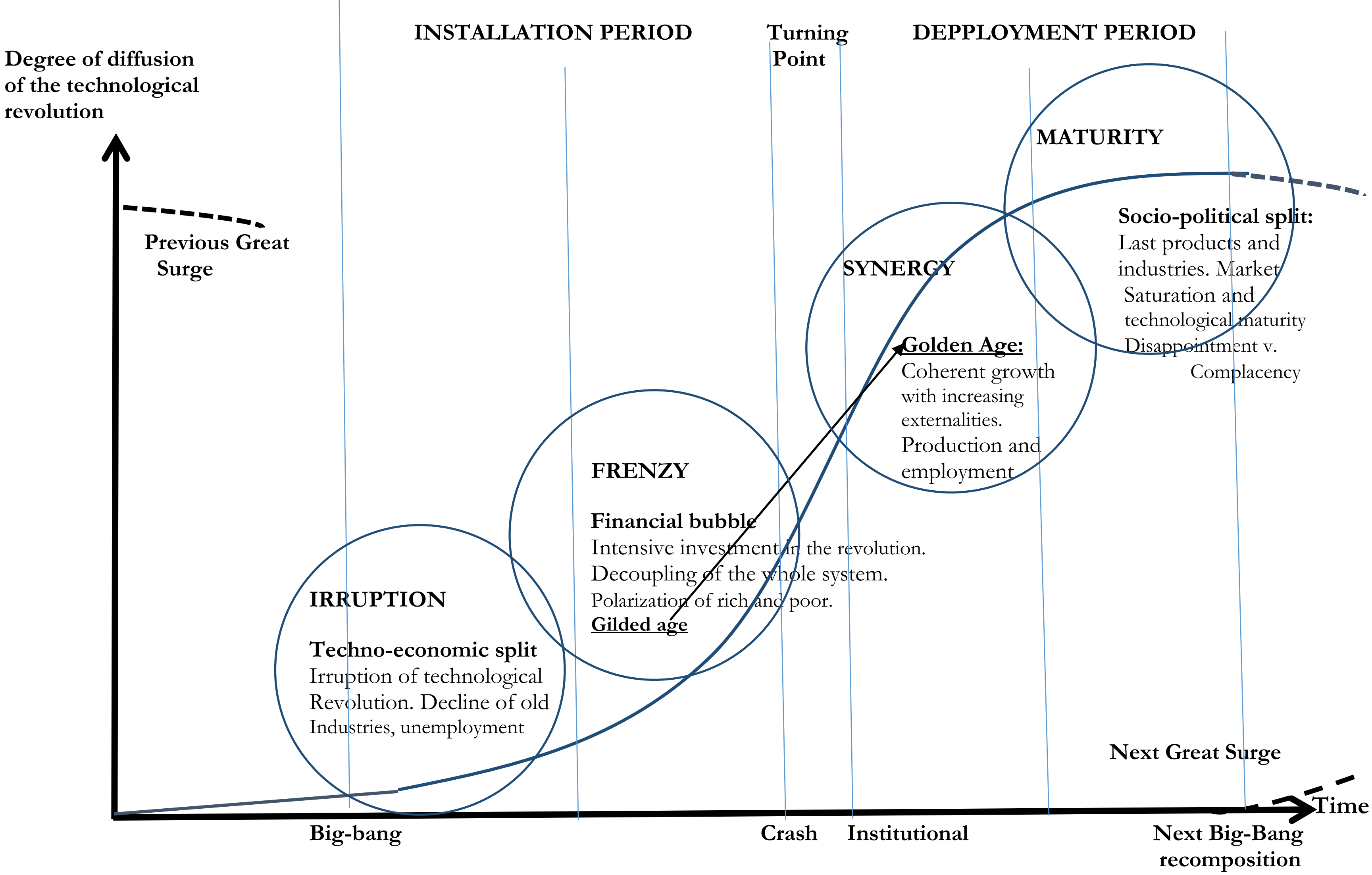
Exhibit IV-1, shows the process of capitalist technology revolutions, using a diffusion curves, which provides a strong linkage to that diffusion literature, as discussed in Appendix f

. and Exhibit IV-2, shows the stages that each of the capitalist technology revolutions have passed through in the industrial era.

As shown in Exhibit IV-1, Perez argues that technological revolutions are launched by major technological innovations whose superiority in resource generation provides the fuel for a great surge of development. The surge lays the foundation for the development of a new Techno-Economic Productive Paradigm. The surge does not reach its full potential until a socio-economic, organizational paradigm forms to control and direct the full range of social institutions and actions in a manner that is supportive of the Techno-economic Productive Paradigm.

[47] Perez (2002) provides the most complete discussion.

EXHIBIT IV-1: RECURRING PHASES OF EACH GREAT SURGE OF THE TECHNOLOGICAL REVOLUTIONS IN THE CORE COUNTRIES



Source: Carlota Perez, *Technological Revolutions and Finance Capital* (Edward Edgar, 2002), Figures 5.1

EXHIBIT IV-2: FIVE SUCCESSIVE TECHNOLOGICAL REVOLUTIONS, 1770S TO 2002, THE HISTORICAL RECORD: BUBBLE PROSPERITIES, RECESSION AND GOLDEN AGES

GREAT SURGE			INSTALLATION PERIOD				TURNING POINT	DEPLOYMENT PERIOD		
	Technological Revolution	Country	Big-Bang	Irruption	Frenzy	Guilded Age Bubble	Recession	Synergy	Golden Age	Maturity
1st	The Industrial Revolution	Britain	1771 Arwrright's mill opens	1770s- early 1780s	late 1780s,- early 1790	Canal mania	1793-1797	1798-1812	Great British leap	1813-1829
2nd	Age of Steam & rail	Britain	1829 Rocket steam engine	1830s	1840S	Railway mania	1848-1850	1859-1857	The Victorian Boom	1857-1873
3rd	Age of Steal & Heavy Engineering	Britain, USA,	1875 Carnegie Bessmer Steel Germany	1875-1884	1884-1893	London Global Infrastructure build up	1893-1895	1895-1907	Belle Epoque Progressive Era	1908-1918
4th	Age of Oil, Autos and Mass Production	USA	1908 Model T	1908-1920	1920-1929	Roaring '20s Autos, Housing Radio, Aviation Electricity	1929 – 1943	1943-1959	Post-war Golden Age	1960-1974
5th	The ICT Revolution	USA	1971 Intel Microprocessor	1971-1987	1987-2001	Dotcom & Internet mania Financial Casino Emerging Markets	2000 2007-2008	20??	Sustainable global knowledge-society "golden age?"	

We are here

Carlota Perez, *Financial bubbles, crises and the role of government in unleashing golden ages*, FINNOV, January 2012:4, *Technological Revolutions and Techno-*

We offered a similar concept and called it "progressive, democratic capitalism."[48] Perez does not use the phrase "progressive capitalism," but she describes a series of surges that capitalist development has produced, once they get the economic and institutional structure right, they can result in a "golden age."[49]

The similarity between Perez's analysis and the previous discussions goes well beyond the use of the diffusion curve to depict technological change. As shown in Exhibit IV-3, she describes the forces that drive the capitalist technological revolutions in exactly the same manner as used by the General Purpose Technology and Innovation discussions in sections II and III.

[48] Mark Cooper, "Progressive, Democratic Capitalism In The Digital Age," 21st Century Technology and 20th Century Law: Where Do We Go from Here? The Fund for Constitutional Government, Conference on Media, democracy and the Constitution, September 27, 2000; "Restoring the Balance of Public Values and Private Incentives in American Capitalism," Too Much Deregulation or Not Enough, Cato Institution, November 1, 2002; Open Architecture as Communications Policy (Stanford Law School, Center for Internet and Society: 2004)

[49] F. M. Sherer and David Ross (*Industrial Market Structure and Economic Performance*, Houghton Mifflin, 1990:4) identify several important measures of "good performance" that are generally considered progressive. "The operation of producers should be progressive, taking advantage of opportunities opened up by science and technology to increase output per unit of input and to provide consumers with superior new products, in both ways contributing to the long term growth of real income per capita..operation of producers should facilitate stable full employment of resources… The distribution of income should be equitable." Perez argues that capitalist development needs to be progressive in these senses "Technology is the fuel of the capitalist engine. (155) The potential for production and productivity growth is considerable. What is needed for its realization is a new space for the unhindered expansion of markets, favoring economics of scale and fostering a new wave of investment. This essentially means that adequate regulation… has to be established and an institutional framework favoring the real economy over the paper economy needs to be put in place… So the rhythm of potential growth is modulated by the qualitative dynamics of effective demand. Therefore, even if the quantity of money out there equals the value of production, if it is not in the right hands, it will not guarantee that market will clear. (114-116) Since market saturation is one of the main limits encountered in deploying the growth potential of a technology revolution, ensuring consistent extension of markets is the way to facilitate the pursuit of those goals. Consequently, it is progressive distribution and worldwide advances in development that can best guarantee a continued expansion of demand. (124)." The process is dynamic and chaotic. It could be that it is in the nature of capitalism to advance by going to extremes in pendular movements: from the installation periods, characterized by the unhindered unleashing of private profit seeking, to the deployment periods, when those forces are moderated and ordered for more widespread social benefits. (159)

EXHIBIT IV-3: THE DETAIL OF THE PROCESSES OF TECHNOLOGICAL REVOLUTION

Techno-economic paradigm: [F]or society to veer strongly in the direction of a new set of technologies, a highly visible 'attractor' needs to appear symbolizing the whole new potential and capable of sparking the technological and business and imagination of a cluster of pioneers. This attractor is not only a technical breakthrough. What makes it so powerful is that it is also cheap or that it makes it clear that business based on the associated innovation will be cost-competitive… A techno-economic paradigm is, then, a best-practice model made up of all-pervasive technological and organizational principles, which represent the most effective way of applying a particular technological revolution and of using it for modernizing and rejuvenating the whole of the economy. (11, 15)

Experimentation: It *is the opening of a wide design, products and profit space* that rapidly fires the imagination of engineers, entrepreneurs and investors, who in their trial and error experiments applying the new wealth creating potential, generate the successful practices and behaviors that gradually define the new best-practice frontier.

Synergies and Specialized Service: Each technological revolution results from the synergistic interdependent of a group of industries with one or more infrastructure networks. (13)

[T]he new technologies will require the establishment of a whole network of interconnected services such as the specific infrastructure and the specialized supplies, distribution channels, maintenance capabilities and others that provide territorial externalities to facilitate diffusion. (41)

Venture capital: It is here that the separation between financial and production capital has it most fruitful consequences. It is because there is available money looking for profits In the hands of non-producers that the new entrepreneurs can bring their ideas into commercial reality. Financial capital will back the new entrepreneurs and it will be more likely to do so, in spite of high risk, the more exhausted the possibilities are for investing in the accustomed directions. (33)

So, the most salient characteristic of these times of revolutionary breakthroughs and multiple trial and error applications is also an innovative attitude in the creation of risk capital instruments on the part of financial capital. (91)

Virtuous Cycles: All this economic and social effort becomes a set of externalities for further investment and wealth creation based on market expansion and compatible innovations. Thus there is a virtuous cycle of self-reinforcement for the widest possible use and diffusion of the available potential. (42)

There are two areas, though, where cost reduction innovations are crucial for the growth of the whole economy: the core inputs and the infrastructure. If these are cheaper and better, more and more producers will use them to modernize their products and processes and to increase their own markets. A virtuous cycle ensues, as this growth in demand will in turn facilitate further gains in productivity in the inputs and the infrastructure themselves. (137)

Externalities: The action of these pioneering agents blazes the trial, giving rise to increasing externalities and conditionings – including production experience and the training of consumers – that make it easier and easier to follow suit. Their success becomes a powerful signal in the direction of the most profitable windows of opportunity (16)

Spread: [E]ach of those sets of technological breakthrough spreads far beyond the confines of the industries and sectors where they originally developed. (8)

[O]nce the design, product and profit space of a new paradigm is made visible, the imagination of a vast number of potential engineers, designers and entrepreneurs is fired to innovate within the new general trajectories. As available finance makes their projects possible and as their astounding success makes the paradigm even more visible and attractive to a greater number of people, the ranks of those that feel the calling will invariably swell (34).

Industrial structuring: With the advent of computers and the Internet, large pyramids now appear rigid and clumsy. In its place, the decentralized flexible network structure, with a strategic core and a rapid communications system, has shown its capacity for accommodating much larger and more complex global organizations as well as smaller ones. (19)

One of the features of the current surge is the importance of innovations as creators of value and the ease with which changes can be introduced in production, due to flexible equipment and organizations. This will certainly define much more dynamic relationships for promoting and financing technical change. 136

Conservatism of the Incumbents Someone's money has to be available to break the routine trajectories and make radical changes. The big established firms, as they face paradigm constriction, will probably put forward money to stretching solutions to their own products and processes, which could involve, as they often do, minor uses of radical new technologies.

Power: One of the early solutions that the most powerful firms find to confront the signs of exhaustion is increasing market control. This is achieved by various means: through mergers… by squeezing out of market or buying up smaller competitors to create closed oligopolies or by acquiring firms in other sectors to build diversified giants… This type of drive form monopoly power is a response to dwindling market growth. (82)

Inertia: It is precisely the need for reforms and the inevitable social resistance to them that lies behind the deeper crisis and longer-term cyclical behavior of the system… But while competitive forces, profit seeking and survival pressures help diffuse the changes in the economy, the wider social and institutional spheres where change is also needed are held back by the strong inertia stemming from routine, ideology and vested interests. (26)

Role of the State: It is the swing of the pendulum from the extreme individualism of Frenzy to giving greater of attention to collective well-being, usually through the regulatory intervention of the state and the active participation of other forms of civil society. What is held here is that this switch does not occur for ideological or voluntaristic reasons but as the result of the way in which the installation of a new paradigm takes place. The unsustainable structural tensions that build up in the economy and society, especially during Frenzy, must be overcome by a recomposition of the conditions for growth and development… Conditions are ripe for regulation to be conceived, implemented and accepted, both to put order in financial markets and to move towards full market expansion and greater social cohesion. But nothing guarantees that decision makers will take this route. This is, in fact, a time of indetermination, when the particular *mode of growth* that will shape the world of the next two or three decades is defined. (52-53)

Yet not only private capital is conducive to the development of revolutions industries in the early days…. In fact, the catching-up periods… had strong backing from the state in various areas, particularly in acquisition of technology… immigration of skilled personnel and technical education and training… (93)

B. INSTITUTIONAL RECOMPOSITION

The long historical view brings a crucial perspective to thinking about how societies have reacted to these technological revolution . It adds several insights that are important to the effort to preserve the environment in which the "virtuous cycle" can flourish.

First, above all, as shown in Exhibit IV-5, the framework makes the sharp differences between the mass market phase of the 20th century and the information/telecommunications phase of the 21st century. Simply put, we are living in a completely different world.

Second, Perez argues we are at the turning point in the trajectory to such a golden age. She notes these turning points are chaotic, intense political periods, of great importance.[50] We

[50] Carlota Perez, Technological Revolutions and Techno-economic Paradigms, Working Papers in Technology Governance and Economic Dynamics, January 2009; Financial bubbles, crises and the role of government in unleashing golden ages, FINNOV, January 2012.

have argued that the digital revolution is facing the maturation challenges of its quarter life crisis.[51]

EXHIBIT IV-4: THE FOURTH AND FIFTH STAGES OF THE INDUSTRIAL REVOLUTION

20th Century Age of Mass Production	**21st Century Age of Information and Telecommunications**
Techno-Economic, Productive Paradigm	
Mass Production/mass markets	Segmentation of markets/proliferation of niches
Economies of scale (product and market volume)	Economies of scope and specialization combined with scale
Standardization of production	Heterogeneity, diversity, adaptability
Energy intensity	Information intensity
Synthetic materials	Microelectronic-based ICT
Socio-Institutional, Organizational Paradigm	
Horizontal integration	Inward and outward cooperation and clusters
Functional specialization	Decentralized integration
Hierarchical pyramids	Network structures
National powers, world agreements and confrontations	Globalization/interaction between the global and the local
Centralized/metropolitan centers-suburbanization	Instantaneous global contact and action and communications

Carlota Perez, *Technological Revolutions and Techno-economic Paradigms,* Working Papers in Technology Governance and Economic Dynamics, January 2009:18

Third, Perez argues that it is important to put forward a new set of institutional solutions to govern the techno-economic paradigm that is consistent with its new economic principles. Her description of these turning points fits the contemporary debate perfectly.

> The design of appropriate policies at each turn requires identifying the direction of change by understanding the paradigm and identifying the phase of the surge. Neither task is simple nor are both the willingness to understand and the goals pursued when responding politically conditioned….
>
> [T]periods of installation are times of cleavage inside political and ideological groupings. Whatever form they had taken in the previous surge, whatever their location in the rough distinction between the individualistic and the socially responsible positions, an internal divide begins to cross each group…
>
> The new line is drawn between those we who look back with nostalgia, trying to hold on to past practices, and those who embrace the new paradigm and propose new institutions to fit new conditions. This blurs the previous connection between certain

---

[51] Cooper, 2013, The Long History and Increasing Importance of Public Service Principles For 21st Century Public Digital Communications Networks, *Journal on Telecommunications and High Technology Law,* 2014.

> values or goals and the specific means of attaining them. Though the goals may remain unchanged, the adequate and viable means to pursue them change with each paradigm shift.

Our long run historical analysis noted "constancy of the principle, evolution of its implementation."[52] In our comments in the PSTN proceeding we argued that preserving and adapting institutions to reflect fundamental values is the challenge.

> As the PSTN is transformed into the public digital communications network (PCDN) the old technology may sunset, but the fundamental values should not. Thus, we reject the claim that the public service principles are antiquated, obsolete hindrances to progress. On the contrary, they are fundamental values; tried and true guideposts that ensure progress in a long march to economic and political freedom.[53]

> The inefficacy of the old institutions to handle the emerging technological revolution and the drive of financial capital for free-wheeling action come together to dismantle the restraining regulatory framework. The confrontation between the defenders of the old regime and the aggressive new deregulators – strong from riding on the high waves of the technological revolution in the midst of a sea of economic troubles – leaves little space for the proposal and acceptance of the required new and modern rules.[54]

The key is to develop a new set of institutions[55] that adapt[56] to the emerging techno-economic paradigm. Institutional inertia proves to be more challenging than inertia in the economy.[57] Perez argues that the key step in building the new institution is to restore the balance between the market and the institutions that regulate it – the state.

[52] Cooper, 2004:113.

[53] Mark Cooper, Reply Comments Of The Consumer Federation Of America, Federal Communications Commission, In the Matter of Technological Transition of the Nation's Communications Infrastructure GN Docket No. 12-353, February 25, 2013:2.

[54] Perez, 2002:165-166.

[55] Perez, 2002:145, An adequate set of institutions is needed to complement, shape and guide the transformation that is taking place in the economic sphere. Yet, it cannot be a blissful return to what worked in the previous paradigm; it must be the complex design of what will work in the new one.

[56] Perez, 2002:113, But the basic conditions for ushering in a period of synergy, convergence and prosperity… is *adaptive regulation.* The *socio-institutional framework* adapts to each paradigm and, in turn, shapes the preferred direction in which technological potential will be deployed and how its fruits will be distributed. (153)

[57] Proposals can only be effective, however, when bearing in mind that institutional change is much slower and culturally more complex than technological or economic change. Overcoming the inertia of vested interest, long-held prejudices and dogmas, cultural views, practical routines and ingrained habits, especially when they had previously been successful, requires impressive events and powerful political pressures…

> The extremely long period of installation since the 1970s, characterized by increasingly globalized free competition, nurtured the idea that market were all that counted and that the state was incompetent and its influence undesirable in the economic sphere... As time moves on and free competition is replaced by global oligopolies, as has occurred in past surges and has been happening in many sectors, more widespread doubts are likely to arise. Gradually, with or without a truly deep depression, it is quite probable that institutions and regulation will again be deemed necessary. Perhaps then those economists and other social scientists that propound the importance of combining state and market may once more find a good place under the sun.[58]

Our analysis at the onset of what Perez identifies as the turning point in the development of the Information/Telecommunication phase launched from this theme.

> [P]rogressive, democratic capitalists… US capitalism dominated the 20th century because we found the right balance between private incentives and public responsibilities. Unlike the Germans and the Japanese, who relied on industrial cartels, and the French and the English, who subjugated their capitalism to state bureaucracies, we found a way to impose social obligations without undermining the profit motive.
>
> I recognize that regulation can go too far, creating too heavy a social obligation, which will slow the capitalist economic engine down. However, I also insist that we can go too far in deregulating, encouraging antisocial behavior, and allowing the capitalist engine to spin wildly out of control. Balance is the key. In the 1990s, irrational exuberance for deregulation destroyed the balance between the public and the private in a number of critical, infrastructure industries—electricity, telecommunications, finance—and we are suffering for it.[59]

Our long historical review of capitalist development sees open communications systems as a central pillar on which the edifice stands.

> The dynamic effect of open communications networks in the digital age is only the most recent iteration of a broader process that has been unfolding over half a millennium. .. [T]he Computer Inquiries were an evolution of the common carrier principles to preserve open communications in the information age. We gain another perspective on the importance of open communications networks by placing recent developments in the long sweep of history. By doing so we find that open communications and transportation networks are deeply embedded in the very DNA of capitalism.
>
> As capitalism was dissolving feudalism, the emerging social order discovered an important new social, political and economic function – mobility. Physical and social mobility were anathema to feudalism, but essential to capitalism and democracy. Providing for open and adequate highways of communications were critical to allow

[58] Perez, 2002:162-163.
[59] Cooper, 2002:1.

commerce to flow, to support a more complex division of labor and to weave small distant places into a national and later global economy.[60]

[60] Cooper, 2004: 111-112.

V. A BROAD FRAMEWORK FOR ANALYZING MARKET FAILURE[61]

The discussion in section IV reflects the continual tension in progressive capitalism between pervasive market barriers, obstacles and imperfections and surges of technological and institutional innovation that reduce the barriers and carry the economy and society to a higher level of economic output and human welfare. Given the persistence and pervasiveness of this tension and the centrality of the process to economic development, we should not be surprised to find that the issue of market barriers and imperfections has received a great deal of attention in the economic literature.

A. THE TRADITIONAL APPROACH: EXTERNALITIES AND MARKET STRUCTURE

Market failure is a sufficiently widespread phenomenon to be recognized as an important analytic issue even for introductory economic texts. In one widely used text, John Taylor states that "in certain circumstances – called market failure – the market economy does not provide good enough answers to the "what, how and for whom" questions, and the government has a role to play in improving on the market"[62] Taylor defines market failure as "any situation in which the market does not lead to an efficient economic outcome in which there is a potential role for government."[63] Taylor identifies the "major sources of market failure as "public goods, externalities, and monopoly power."[64] In this framing, market power is one-third of the problem.

An advanced text on antitrust and regulation offers the following observation on the importance of market failure in economic analysis:

> If we existed in a world that functioned in accordance with the perfect competition paradigm, there would be little need for antitrust policies and other regulatory efforts.

---

[61] Excerpted and updated from: Mark Cooper and Barbara Roper, Reform of Financial Markets: The Collapse of Market Fundamentalism and the First Steps to Revitalize the Economy (Consumer Federation of America, March 2009); Comments of the Consumer Federation of America, Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, November 27, 2009.
[62] John B. Taylor, Economics New York: Houghton Mifflin, 1998), p. 49.
[63] Taylor, Economics, p. 405.
[64] Taylor, Economics, p. 404.

> All markets would consist of a large number of sellers of a product and consumers would be fully informed of the product's implications. Moreover, there would be no externalities present in this idealized economy, as all effects would be internalized by the buyers and sellers of a particular product.
>
> Unfortunately, economic reality seldom adheres closely to the textbook model of perfect competition. Many industries are dominated by a small number of large firms. In some instances, principally the public utilities, there may be a monopoly. Consumers who use hazardous products and workers who accept risky employment may not fully understand the consequences of their actions. There are also widespread externalities that affect the air we breathe, the water we drink, and the future viability of the planet.[65]

These citations identify three broad areas of analysis that are common in the literature.(1) structural conditions of supply, e.g. lack of competition (small numbers or monopoly); (2) consumer behavior, e.g. ill-informed or unaware, and (3) societal, e.g. externalities and products like public goods. Over the past several decades criticism of and refinements to the traditional economic model have expanded the analysis of factors that cause markets to fail to arrive at outcomes that have traditionally been defined as efficient.[66]

1. Societal

The societal category refers to situations in which important values are not reflected in market transactions. The traditional example is externalities.[67] However, the category should be expanded to include network effects, which are sometimes referred to as network externalities,[68]

---

[65] W. Kip Viscusi, John M. Vernon and Joseph E. Harrington, Jr., *Economics of Regulation and Antitrust,* Cambridge: MIT Press, 2001), p. 2.

[66] A constructive view is taken by leading behavioral economists (Amerer, Colin, F. and George Lowensetin, "Behavioral Economics: Past, Present, Future," in Colin f. Camerer, George Loewenstein and Matthew Rabin (Eds.), *Advances in Behavior economics*(New York: Russel Sage foundation, 2004), p. 3: "This conviction does not imply a wholesale rejection of the neoclassical approach to economics based on utility maximization, equilibrium, and efficiency. The neoclassical approach is useful because it provides economists with a theoretical framework that can be applied to almost any form of economic (and even noneconomic) behavior, and it makes refutable predictions. Many of these predictions are tested in the chapters of this book, and rejections of those predictions suggest new theories.

[67] Taylor, p. defines an externality as a "situation in which the costs of producing or the benefits of consuming a good spillover onto those who are neither producing nor consuming the good."

[68] "In economics and business, a **network effect** (also called **network externality** or **demand-side economies of scale**) is the effect that one user of a good or service has on the value of that product to other people. When network effect is present, the value of a product or service increases as more people use it." http://en.wikipedia.org/wiki/Network_effect

innovation economics,[69] and the general proposition that non-economic values are often the drivers of human activity. It can be argued that the importance of innovation economics derives significant support from the new institutional economics and the importance of non-economic values derives significant support from behavioral economics.

2. Endemic

Some of the problems that have long been recognized in traditional economics and could be located within the structural category involve such fundamental assumptions about the functioning of markets that are so frequently violated they rise to the level of endemic problems. Here, too, it can be argued that new institutional and behavioral economics support the proposition that these flaws deserve special attention. Joseph Stiglitz, Nobel Laureate, Chairman of the Council of Economic Advisors and Chief Economist at the World Bank, identified the threat problem that these flaws pose in the financial sector well before the financial meltdown.

> **Conflicts of Interest** "Deregulation enhanced the scope for conflicts of interest. It also had the advertised effect of increasing competition. In normal circumstances, increased competition is a good thing. But in the nineties, the banks became so eager for short-term profit that here was a race to the bottom. Each bank knew that be left behind; and each banking officer knew what that meant; small bonuses, perhaps even being fired. (p. 13)
>
> **Perverse Incentives:** The CEOs and other executives of corporations are supposed to act in the best interests of the corporations, its shareholders and workers; but in the nineties, incentives got badly misaligned. In acting in their own interests, CEOs often did not serve well those on whose behalf they were supposed to be working. The irony was that the changes in pay structure which were at the root of much of the problem were defended as improving incentives... Investment houses became marketers…. They did what it took to sell what they could sell p. 149,
>
> **Asymmetric Information:** For the stock market to function well, there needs to be accurate information about what a company is worth so that investors can pay the right price for its shares. By obfuscating the problems inherent in many of the companies they brought to the market or for which they helped raise capital by issuing shares, the

[69] Innovation economics is based on two fundamental tenets: that the central goal of economic policy should be to spur higher productivity and greater innovation, and that markets relying on price signals alone will not always be as effective as smart public-private partnerships in spurring higher productivity and greater innovation. http://en.wikipedia.org/wiki/Innovation_economics

> banks contributed to the erosion of the quality of information. They were supposed to provide information to investors, to reduce the disparity between informed insiders and outsiders. Instead, asymmetries of information maintained or increased; in many cases, bankers and analysts knew the real state of affairs about the companies they worked with but the public did not. Confidence in the markets declined, and when the correct information came out, share prices declined sharply.[70]

3. Transaction Costs and the New Institutional Economics

Transaction cost economics is framed as a critique of neoclassical economics.

> The costliness of economic exchange distinguishes the transaction cost approach from the traditional theory economists have inherited from Adam Smith… An exchange process involving transaction costs suggests significant modifications in economic theory and very different implications for economic performance.[71]

Transaction costs analysis launches from the observation that there is friction in human activity that is not accounted for in the neoclassical models of economic behavior. Failing to take transaction costs into account misrepresents the cost of action and therefore the pattern of activity that occurs. Noting the difference from neoclassical assumptions, Douglass North, one of the first to receive a Nobel Prize in this school of economics, argued as follows.

> If political and economic markets were efficient (i.e., there were zero transaction costs) then the choices made would always be efficient. That is, actors would always possess true models or if they initially possessed incorrect models the information feedback would correct them. But that version of the rational actor model has simply led us astray. The actors frequently must act on incomplete information and process the information they do receive through mental constructs that can result in persistently inefficient paths….
>
> The theory is based on the fundamental assumption of scarcity and hence competition; its harmonious implications come from its assumptions about a frictionless exchange process in which property rights are perfectly and costlessly specified and information is likewise costless to acquire. Although the scarcity and hence competition assumption has been robust and has provided key underpinnings of neoclassical theory, the other assumptions have not survived nearly so well.
>
> For the past thirty years, other economists and other social scientists have been attempting to modify and refine the issue to see just what have been missing from the

[70] Joseph E. Stiglitz, The Roaring Nineties: A New History of the World's Most Prosperous Decade (New York: W.W. Norton, 2003) (p. 141)

[71] Douglass C. North, *Institutions, Institutional Change and Economic Performance* (Cambridge: Cambridge University Press, 1990), p. 27.

> explanation. Put simply, what has been missing is an understanding of the nature of human cooperation and coordination.[72]

Information is the resource at the center of transaction cost and institutional economics because "the costliness of information is the key to the costs of transacting, which consists of the costs of measuring the valuable attributes of what is being exchanged and the costs of protecting rights and policing and enforcing agreements."[73]

Institutions are formed to manage and reduce transaction costs.

> Institutions provide the structure for exchange that (together with the technology employed) determines the cost of transacting and the cost of transformation. How well institutions solve the problems of coordination and production is determined by the motivation of the players (their utility function), the complexity of the environment, and the ability of players to decipher and order the environment (measurement and enforcement).[74]

The building of organizations may create inertia, lock in on inefficient solutions, or conflicts of interest that result in wide deviation from the second best solution that the institutions are intended to achieve[75] The deviation of the institutions from their ideal is the result of the difficulty of enforcement, "there are two reasons why enforcement is typically imperfect… the cost of measuring the multiple margins that constitute contract performance [and] the fact that enforcement is undertaken by agents whose own utility functions influence outcomes."[76] Central to the challenge of monitoring, is the agency issue. "The agency issue is ubiquitous in hierarchical organizations. The problem of monitoring and metering the various attributes that constitutes the performance of agents in contrast to the standard neoclassical frictionless model.[77] Thus, agency, asymmetric information and conflicts of interests are the barriers and imperfections in that drive organizations farther from the goal of efficiency.

[72] North, p8…. 11.
[73] North, p. 27.
[74] North, p. 34.
[75] North, p. 7.
[76] North, p. 54.
[77] North, p. 32.

4. Behavioral Economics

Over three decades, behavioral economics has sought to extend the traditional economic model by incorporating more realistic assumptions about human behavior.

> At the core of behavioral economic analysis is the conviction that increasing the realism of the psychological underpinnings of economic analysis will improve the field of economics *on its own terms* – generating theoretical insights, making better predictions of field phenomena, and suggesting better policy…
>
> For example, there is nothing in core neoclassical theory that specifies that people should not care about fairness, that they should weight risky outcomes in a linear fashion, or that they must discount the future exponentially at a constant rate. Other assumptions simply acknowledge human limits on computational power, will power, and self-interest.[78]

The neoclassical paradigm at the core of market structural analysis makes assumptions about the nature of human behavior that are necessary for its propositions and conclusions to be valid. Economic actors are presumed to be narrowly focused on their own economic interest and fully capable of pursuing those interests with rational precision. People are assumed to rationally and consistently pursue selfish, utility maximization according to a time consistent discounting model based on Bayesian probabilities for outcomes in which all income and assets are fungible.[79]

Behavioral economics challenges every assumption of this model of economic actors at the level of motivation, perception and calculation. For purposes of policy analysis, we believe the findings of behavioral economics can be usefully divided into four groups – motivation, perception, calculation and execution. Wilkinson's *Introduction to Behavioral Economic,* has

[78] Camerer, Colin, F. and George Lowensetin, "Behavioral Economics: Past, Present, Future," in Colin f. Camerer, George Loewenstein and Matthew Rabin (Eds.), *Advances in Behavior economics* (New York: Russel Sage Foundation, 2004), p. 3.

[79] Paraphrasing Wilkinson, Nick, *An Introduction to Behavioral Economics* (Hampshire, Palgrave, 2008); Camerer, Colin F, George Lowenstein and Matthew Rabin (Eds.), *Advances in Behavioral Economics* (New York: Russell Sage, 2004). Introduction, p. 5.

two sets of chapters, one foundational, one advanced, that can be organized according to this scheme in Exhibit V-1:

EXHIBIT V-1: THE BASIC BEHAVIORAL CRITIQUE OF THE NEOCLASSICAL ECONOMIC MODEL

Motivation:	Foundations: Values, Attitudes, Preferences and Choice, Nature and Measurement of Utility Advanced: Fairness and Social Preferences
Perception:	Foundations: Decision-making under Risk and Uncertainty, Utility Theory, Prospect Theory, Reference Points, Loss aversion, Decision Weighting Advanced: Behavioral Game Theory, Learning
Calculation:	Foundations: Mental Accounting, Framing and Editing, Choice Bracketing Advanced: The Discounted Utility Model, Alternative Intertemporal Choice Models
Execution:	Foundations: Decision-making under Risk and Uncertainty, Budgeting and Fungibility Advanced: Bargaining, Signaling

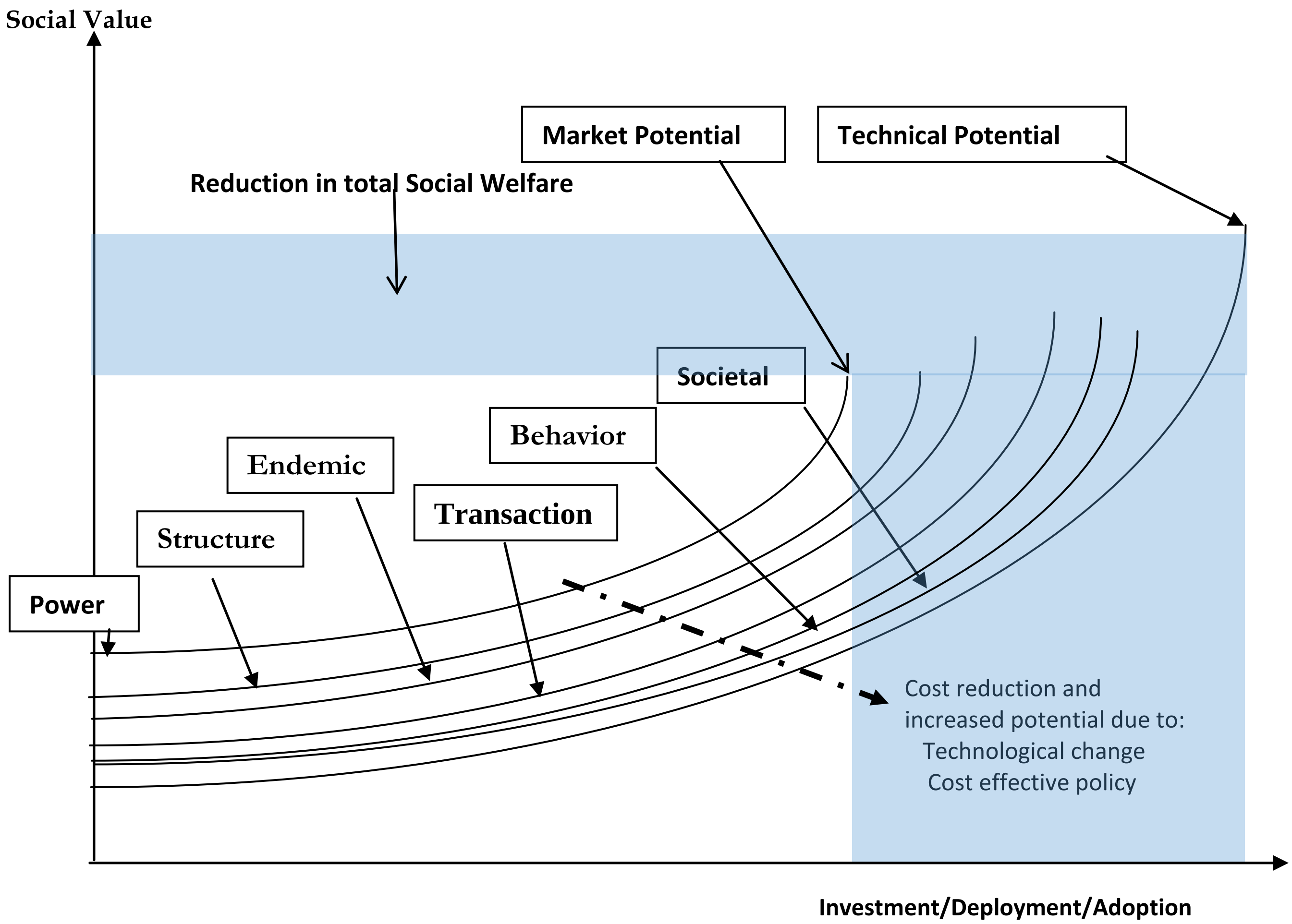
Sources: Wilkinson, Nick, *An Introduction to Behavioral Economics* (Hampshire, Palgrave, 2008), has two sets of chapters, one foundational, one advanced, that yield this set of categories. See also Camerer, Colin F, George Lowenstein and Matthew Rabin (Eds.), *Advances in Behavioral Economics* (New York: Russell Sage, 2004) and R. E. Prasch, *How Markets Work: Supply, Demand and the Real World* (Cheltenham: Edward Elgar, 2008

B. BROAD ANALYTIC FRAMEWORKS

One way to introduce these market barriers and imperfections into the analysis is to view them as factors that cause underinvestment in beneficial technologies, as shown in Exhibit IV-2. The actual level of investment falls far short of the optimum, reducing social welfare dramatically. Technology and policy can help to overcome the underinvestment, shifting the economy to a higher level of performance.

Exhibit IV-3 shows a long list of market barriers and imperfections that can lead to market failure. Definitions and examples are provided in Appendix E. These are from the long-standing analysis of energy efficiency and the contemporary analysis of climate change. Over the course of three decades these literatures have devoted a great deal of attention to market barriers, imperfections and failure because of the urgent need to stimulate innovation in an important sector of society. Two thirds of the individual market failures identified in the literature have been mentioned in earlier analysis.

V-1: MARKET IMPERFECTIONS SHIFT THE INVESTMENT FRONTIER LEADING TO UNDER INVESTMENT, LOWER ADOPTION AND REDUCTIONS IN SOCIAL WELFARE



Source: Derived from Jayant Sathaye and Scott Murtishaw, *Market Failures, Consumer Preferences, and Transaction Costs in Energy Efficiency Purchase Decisions* (California Energy Commission, November 2004), consultant report, p. 11.

Exhibits IV-4 presents another view on market barriers and imperfections that relate it to the Innovation Systems literature. The underlying study utilized the seven function discussed earlier and evaluated three sectors that are relevant to the discussion of innovation in thbio)e digital techno-economic paradigm – mobile data (MD), IT in home care, and Biocomposites

EXHIBIT IV-3: COMPREHENSIVE LIST OF IMPERFECTIONS THAT CAUSE MARKETS TO FAIL

NEOCLASSICAL & INDUSTRIAL ORGANIZATION ECONOMICS — **NEW INSTITUTIONAL & BEHAVIORAL ECONOMICS**

INDUSTRY STRUCTURE	SOCIETAL FLAWS	ENDEMIC	BEHAVIORAL FACTORS
Imperfect Competition	Traditional Externalities	TENDENCIES	Motivation Values
Concentration	Positive	Asymmetric Information	& Commitment
Barriers to Entry	Negative	Agency	Bounded Selfishness/wants
Scale	Public Goods	Moral Hazard	Morality
Vertical Leverage	Basic research	Adverse Selection	Fairness/reciprocity
Collusion	Information	Perverse Incentives	Altruism
ICE problems	Learning-by-doing	Conflict of Interest	Preference

TRANSACTION COST FRICTION

Search and Information
- Imperfect Information
  - Availability
  - Accuracy
  - Search Cost

Bargaining
- Risk & Uncertainty
  - Technology
  - Marketplace
  - Policy
  - Financial
  - Liability

Enforcement
- Switching costs
- Sunk costs

POWER

Legal Framework
- Property
- Contract

Policy
- Taxation
- Subsidies
- Protectionism
- Trade

Antitrust Enforcement
- Toward Structure
  - Market Dominance
  - Merger
- Toward Behavior

Regulatory Capture

(Bio). The first graph shows the characterization in the Innovation System framework. The second graph allocates the impediments across the major categories of market barriers. The obvious point in the context of the current analysis is that market power (oligopoly) plays a very small role.

EXHIBIT V-4: IMPEDIMENTS TO INNOVATION

Impact on Innovation System Functions

FUNCTIONS AFFECTED	IMPEDIMENTS	SECTORAL EXAMPLES		
Development of Externalities	Fragmented ICT Resposibility	MD		
Development of Externalities	Lack of standards	MD		
Development of Externalities	Small, specific market	MD		
Entrepreneurial Experimentation	Cautious VC and weak capital market	MD		
Entrepreneurial Experimentation	Lack of competence		IT Home	
Entrepreneurial Experimentation	Lack of knowledge about applications, markets and business models	MD		
Entrepreneurial Experimentation	Lack of standards	MD		
Entrepreneurial Experimentation	No prime mover	MD		
Entrepreneurial Experimentation	Oligopoly	MD		
Entrepreneurial Experimentation	Poor articulation of demand		IT Home	
Entrepreneurial Experimentation	Small, specific market	MD		
Entrepreneurial Experimentation	Uncertainty about applications, markets and business models	MD		
Entrepreneurial Experimentation	Uncertianty of need among potential consumers		IT Home	
Entrepreneurial Experimentation	Weak Innovation	MD		
Influence Direction of Search	Lack of competence/poor articulation of demand		IT Home	
Influence Direction of Search	Lack of knowledge about applications, markets and business models	MD		
Influence Direction of Search	Lack of standards	MD	IT Home	
Influence Direction of Search	No prime mover	MD		
Influence Direction of Search	Oligopoly	MD		
Influence Direction of Search	Uncertainty about applications, markets and business models	MD		
Influence Direction of Search	Weak Innovation	MD		
Knowledge Development	Fragmented Research	MD		
Knowledge Development	Lack actors and resources in middle of value chain			Bio
Knowledge Development	Lack of integration between subsystems			Bio
Knowledge Development	Lack of knowledge about applications, markets and business models	MD		
Knowledge Development	Lack of meeting places			Bio
Knowledge Development	Lack of Vision			Bio
Knowledge Development	Large firms downsizing	MD		
Knowledge Development	Large firm secrecy			Bio
Knowledge Development	Poor articulation of demand			Bio
Knowledge Development	Uncertainty about applications, markets and business models	MD		Bio
Legitimation	Lack of knowledge about applications, markets and business models	MD		
Legitimation	Uncertainty about applications, markets and business models	MD		
Legitimation	Uncertianty of need among potential consumers		IT Home	
Legitimation	Weak advocacy		IT Home	
Market Formation	Cautious VC and weak capital market	MD		
Market Formation	Inadequate knowledge of link between investments and benefits		IT Home	
Market Formation	Lack of knowledge about applications, markets and business models	MD		
Market Formation	Lack of standards	MD	IT Home	
Market Formation	No prime mover	MD		
Market Formation	Oligopoly	MD		
Market Formation	Small, specific market	MD		
Market Formation	Uncertainty about applications, markets and business models	MD		
Market Formation	Uncertianty of need among potential consumers		IT Home	
Market Formation	Weak Innovation	MD		
Resource Mobilization	Cautious VC and weak capital market	MD		
Resource Mobilization	Few university programs		IT Home	
Resource Mobilization	Lack of standards	MD		
Resource Mobilization	Small, specific market	MD		

EXHIBIT IV-4: CONT'D

Impediments in Categories of Market Failure

IMPEDIMENTS	FUNCTIONS AFFECTED	Type of Barrier
Cautious VC and weak capital market	Entrepreneurial Experimentation	Endemic
Cautious VC and weak capital market	Market Formation	Endemic
Cautious VC and weak capital market	Resource Mobilization	Endemic
Few university programs	Resource Mobilization	Societal
Fragmented ICT Resposibility	Development of Externalities	Societal
Fragmented Research	Knowledge Development	Societal
Inadequate knowledge of link between investments and benefits	Market Formation	Structure
Lack actors and resources in middle of value chain	Knowledge Development	Behavior
Lack of competence	Entrepreneurial Experimentation	Behavior
Lack of competence/poor articulation of demand	Influence Direction of Search	Behavior
Lack of integration between subsystems	Knowledge Development	Societal
Lack of knowledge about applications, markets and business models	Entrepreneurial Experimentation	Transaction
Lack of knowledge about applications, markets and business models	Influence Direction of Search	Transaction
Lack of knowledge about applications, markets and business models	Knowledge Development	Transaction
Lack of knowledge about applications, markets and business models	Legitimation	Transaction
Lack of knowledge about applications, markets and business models	Market Formation	Transaction
Lack of meeting places	Knowledge Development	Transaction
Lack of standards	Development of Externalities	Structure
Lack of standards	Entrepreneurial Experimentation	Structure
Lack of standards	Influence Direction of Search	Structure
Lack of standards	Market Formation	Structure
Lack of standards	Resource Mobilization	Structure
Lack of Vision	Knowledge Development	Structure
Large firms downsizing	Knowledge Development	Structure
Large firm secrecy	Knowledge Development	Structure
No prime mover	Entrepreneurial Experimentation	Structure
No prime mover	Influence Direction of Search	Structure
No prime mover	Market Formation	Structure
Oligopoly	Entrepreneurial Experimentation	Structure
Oligopoly	Influence Direction of Search	Structure
Oligopoly	Market Formation	Structure
Poor articulation of demand	Entrepreneurial Experimentation	Structure
Poor articulation of demand	Knowledge Development	Structure
Small, specific market	Development of Externalities	Structure
Small, specific market	Entrepreneurial Experimentation	Structure
Small, specific market	Market Formation	Structure
Small, specific market	Resource Mobilization	Structure
Uncertainty about applications, markets and business models	Entrepreneurial Experimentation	Transaction
Uncertainty about applications, markets and business models	Influence Direction of Search	Transaction
Uncertainty about applications, markets and business models	Knowledge Development	Transaction
Uncertainty about applications, markets and business models	Legitimation	Transaction
Uncertainty about applications, markets and business models	Market Formation	Transaction
Uncertianty of need among potential consumers	Entrepreneurial Experimentation	Transaction
Uncertianty of need among potential consumers	Legitimation	Transaction
Uncertianty of need among potential consumers	Market Formation	Transaction
Weak advocacy	Legitimation	Power
Weak Innovation	Entrepreneurial Experimentation	Power
Weak Innovation	Influence Direction of Search	Power
Weak Innovation	Market Formation	Power

Anna Begek, et al., "Analyzing the Dynamics and Functionality of Sectoral Innovation Systems – A Manual, *Dynamics of Industry and Innovation: Organizations, Networks and Systems,* Copenhagen, 2005.

VI. THE CONVERGENCE OF ECONOMICS AND LAW

A. PROTECTING THE INTERNET INNOVATION SYSTEM

As argued in Section IV, the policy challenge is to preserve the balance between social responsibility and freedom of economic action, but to do so in a manner that preserves and enhances the "virtuous cycle" of the Internet innovation system. The solution is not to simply go back to the 20th century regulatory institutions, rather it is to evolve those institutions in a manner that preserves the essential values and goals, but fits the new economic reality. Over the course of the past decade we have made this case repeatedly in an effort "to engage in the design of regulations and institutions so they will be ready and in the arena of debate when the moment comes for them to be accepted."[80]

The earlier discussion of the vitally important role of FCC decisions in creating the environment in which the digital revolution could thrive not only demonstrates the importance of combining the "state and market,' it also identifies the new direction that the combination should take to support the digital techno-economic paradigm. The direction of progress has already been clearly indicated in the deployment of two of the most dramatically successful changes in the approach to communications in the modern era – the Internet Protocol and unlicensed spectrum (primarily Wi-Fi).

> The Internet protocols and the development of Wi-Fi are remarkable communications systems based on brutally simple obligations of interconnection and integration that are open to all on a nondiscriminatory basis and supported by voluntary standards, managed by multi-stakeholder processes that promote interoperability. A key spark is provided by a regulatory decision of guaranteed access, while a backstop of the threat of further governmental oversight ensures that access is available.
>
> In both cases, the government had an important role in creating the environment in which an entirely new approach to communications could thrive. This is a space that

[80] Perez, 2002:166.

> lies between the market and the state in the sense that the abuse of power by dominant communications companies and government regulators was held in check.[81]

The law is converging to the economics. In ruling on the FCC's data roaming order, the D.C. Circuit Court of Appeals upheld regulations that required dominant firms to offer data roaming services, but relied on private negotiations, with the FCC exercising "backstop" regulatory oversight.

> there is a gray area in which although a given regulation might be applied to common carriers, the obligations imposed are not common carriage *per se*. It is in this realm—the space between *per se* common carriage and *per se* private carriage—that the Commission's determination that a regulation does or does not confer common carrier status warrants deference. *Cf. U.S. Telecom Association*, 295 F.3d at 1331–32 (deferring to Commission's interpretation of "common carrier"). Such is the case with the data roaming rule…
>
> True, providers must offer terms that are "commercially reasonable." But the data roaming rule, unlike the voice roaming rule, imposes no presumption of reasonableness. And the "commercially reasonable" standard, at least as defined by the Commission, ensures providers more freedom from agency intervention than the "just and reasonable" standard applicable to common carriers… The rule itself actually spells out sixteen different factors plus a catch-all "other special or extenuating circumstances" factor that the Commission must take into account in evaluating whether a proffered roaming agreement is commercially reasonable…. The Commission has thus built into the "commercially reasonable" standard considerable flexibility for providers to respond to the competitive forces at play in the mobile-data market. Although the rule obligates Verizon to come to the table and offer a roaming agreement where technically feasible, the "commercially reasonable" standard largely leaves the terms of that agreement up for negotiation.[82]

The data roaming order involved the regulation of service the FCC defined as non-common carrier, mobile services that fall under Title III, for the purposes of achieving the broad goals of the Communications Act. Given the current legal terrain, the Open Internet rules also involve the regulation of non-common carrier services, broadband Internet access service, for the purposes of achieving the broad goals of the Act. The Commission asserted and the D.C. Circuit

[81] Cooper, 2014:35-36.
[82] *Cellco Partnership v. FCC*, 700 F.3d 534, 541, D.C.Cir. 2012:21…24.

Court accepted the proposition that it could regulate Title I service using section 706. In the ruling the Court pointed to the approach it had approved in the data roaming order.[83]

As legal background, it should also be noted that in upholding the FCC Universal Service Reform order, the 10th Circuit Court of Appels affirmed that the FCC has authority to implement universal service reform under section 254 of the Act and section 706.[84] While the Court affirmed the 706 authority, it devoted most of its attention to analyzing (and accepting) the FCC's authority to regulate non-common carrier (information) services that had been swept into Title II through section 254 of the Act.

These three rulings affecting four of the most important public service principles we identified in our comments in the IP transition docket – interconnection, universal service, non-discrimination and innovation at the edge[85] – establish a rich and complex set of legal authorities.

Above all, they make it clear that the authorities overlap – a service can fall under more than one authority simultaneously – and are complementary (in the sense that they trigger different tools for different purposes). Therefore, there is no conflict between asserting the authority and developing the power under each of the Titles and sections of the Act. In fact, as we argued in our earlier comments in this proceeding, it would be imprudent for the Commission not to pursue all of the authorities it has available.

In designing the new regulatory structure that puts flexibility and entrepreneurial experimentation at the center, we should not forget that the successful models developed by the FCC also had bright lines. Where a practice was deemed to pose a fundamental and pervasive threat to the freedom to experiment, the Commission took away flexibility. It controlled the

---

[83] D.C. Circuit, 2014: 47-50.
[84] United States Court of Appeals for the Tenth Circuit, No. 11-9900, May 23, 2014:51.
[85] Cooper, 2013, Attachment A.

ability of the incumbents to do harm, kept them out of information services, and made spectrum available on an unlicensed basis.

The remainder of these comments presents a road map for building the regulatory institutions that will accomplish the long standing goals of U.S. communications policy (the six public service principles we have identified) while supporting the "virtuous cycle" in the digital communications sector. In these initial comments we outline the broad trajectories that the FCC can take in building the institutional structure to implement the public service principles of the Communications Act.

B. The Emerging Regulatory Structure for Non-Common Carrier Services

1. Authority

The regulatory structure that is emerging for non-common carrier services seeks to achieve the goals of the Communications Act as amended by the Telecommunications Act of 1996 by allowing more scope for individual initiative, subject the authority of the Commission. Given the history of the success of commission policy in supporting the Internet innovation system, it makes sense for the Commission to endeavor to stay out of regulating the day-to-day relationships in the space between the market and the state. In any event, under the current classification of services the recent court ruling constrain the way it can regulate these services.

Exhibit V-1 shows the law as defined in the three cases noted above. It also includes another potential source of authority, Title II, which is certain to receive a great deal of attention in this proceeding. The first policy challenge for the Commission is to develop the powers under section 706 to the fullest extent possible and to evaluate whether that is sufficient to achieve the goals of the Act. If it concludes that the powers are not sufficient, it must explore additions powers under Title II. The next section examines several aspects of the Title II question.

EXHIBIT V-1: EMERGING STRUCTURE OF AUTHORITY AND POWER UNDER THE TELECOMMUNICATIONS ACT OF 1996

Goal	Authority	Power/Enforcement
Seamless Interconnection	Title III	Non-common carrier regulation => individual negotiations subject to factors
Universal Service	S. S. 254	Title II ETC classification applies
	S. 706b	Independent source of authority
Reasonable Network Management Transparency Blocking Non-discrimination	S. 706a	An independent source of authority, Non-common carrier regulation => individual negotiations subject to factors
	Title II	Circumstances and actions that require more Power

The most important point to recognize in taking this "all of the above" approach is that there is no conflict between 706 authority and any other authority in the statute because 706 complements other authorities. Section 706 is the "new" law, layered atop the existing statute to accomplish the "additional" goals of communications law expressly outlined in the first sentence of the 1996 Act – "accelerate rapidly private sector deployment of advanced telecommunications and information services." It applies to telecommunications capability wherever it resides in the Act. Nowhere in the 1996 Act does it say it supplants any existing authority, nor did the 1996 Act repeal any existing authority. The recent court cases have made it clear that 706 and other authorities can be invoked simultaneously (although they need not be).[86] While the 706 authority is extremely broad, the courts have interpreted its power as narrow – i.e. restricting it to non-common carrier approaches. The FCC needs to define the power it exercises under section 706 to preserve the environment in which the Internet flourished to the greatest extent possible.

[86] Citing NARUC II, the D.C. Circuit, 2014:60:51"Since it is clearly possible for a given entity to carry on many types of activities, it is at least logical to conclude that one may be a common carrier with regard to some activities but not others."

2. Power

a. Transparency

The most obvious place to start in building the new regulatory model is with enhancement of the transparency rules, which were upheld by the Court. Throughout the economic analysis above users loom large, not only as a source of information, but also as active innovators. Yet, when reform of regulation is the topic of discussion, they have a tendency to disappear. There is no reason that consumers cannot be just as involved in the regulatory process as they have become in the innovative process. They are capable of a lot more effective participation than two sentence e-mails complaining about something.

As discussed in Appendix G, we have argued that participatory governance is not only an effective way to regulate, it also fills an important democratic need. It requires an institutional structure that takes specific verifiable complaints and turns them into actionable items. The key to increasing direct involvement is for the Commission should to ensure that input from civil society can effectively influence the definition and enforcement of acceptable behavior. This means that multi-stakeholder input must occur before, during and after the adoption of rules or norms. The process must be structured and recognized by the FCC to ensure that it is representative, transparent, and effective. To the extent that enforcement is crowd sourced, complaints must be handled in a process that makes them actionable on an expedited basis.

b. Blocking

A second principle that emerges clearly from the discussion of the Internet innovation system is that network operators should not be allowed to block applications. Although the Court overturned the FCC's ban on blocking, it seemed willing to uphold a well-crafted ban.[87] The no blocking rule should have the effect of ensuring that the data traffic flows during any

[87] D.C. Circuit, 2014:60.

negotiations over rates, terms and conditions. The Commission should propose a rule under section 706 to accomplish this. It could assert Title II authority for the same rule (or as discussed below) write a different no-blocking rule under Title II.

3. Non-discrimination

Throughout the commercial history of the Internet, there was some level of transactions that involved negotiations. Edge company data did not magically arrive at the consumers' network interface device. Two transactions were involved in the delivery of data to the consumer. After the edge company receives a request for data from the consumer, the data must be delivered from the edge company to a backbone transmission provider. The backbone transmission provider delivers the data to the consumer's broadband Internet access service provider. Edge companies could use a regulated telecommunication network service to reach the backbone provider. The backbone provider delivered the data to a terminating network service provider under a peering agreement.

With the advent of broadband and huge flows of data moving in the direction of consumers, edge companies began to utilize and deploy content data networks (CDN) to manage their traffic. They can connect directly to backbone providers to send (originate) their data. The edge companies can use CDNs to get large quantities of data close to consumers, but they still must negotiate an agreement to have the traffic delivered to the consumer. The exchange of traffic between terminating network operators and backbone providers has become contentious to say the least, with service interruptions and disputes over pricing and quality.

The disputes focuses on the terminating end of the transmission because the inflow of requests for data does not require a great deal of bandwidth. Large volume edge companies can connect directly to the backbone to originate their distribution of data, but on the terminating end the data must flow through communications network owned by those who provide first mile connectivity. Network operators have proposed to identify specific types of traffic and/or content providers on whom they want to impose different rates, terms and conditions for purposes of delivering (terminating) traffic. These transactions and disputes now threaten the flow of experimentation and commerce at the edge, as discussed earlier in the comments.

In order to minimize the burden on the Internet innovation system, under the D.C. Appeals Court interpretation of section 706, the Commission can impose conditions on the process of negotiation and identify the factors that will be used to evaluate outcomes.

- In terms of process, the Commission could require that
  - The traffic flows during the negotiations – this is a natural extension of the no blocking principle,
  - Self-help should be deemed reasonable, i.e. edge companies that propose to deploy facilities or protocols that solve network problem or increase network capacity of funciotnality should be deemed to be reasonable,
  - The burden of proving that the rates, terms and conditions a network operator wants to impose are reasonable should fall on the network operator.
- In terms of substance, the rates, terms and conditions that are reasonable can be required to meet a series of standards:
  - Not degrade the service of the general public,
  - Non-exclusive,
  - Not anticompetitive,
  - Non-discriminatory,
  - Demonstrate a need for differentiation based on cost or quality of service

C. Changed Legal Circumstances and the Prominence of Section 706

As a foreshadowing of the analysis of Title II, where “changed circumstances” are likely to play a large role, we conclude the discussion of Section 706 by noting two changed circumstances that raise its prominence.

1. The Shifting Emphasis of Broadband Policy

First, the passage of the Broadband Data Improvement Act (2008) and the American Revival and Revitalization Act (2009) have shifted the focus of universal service policy to recognize the importance of adoption and utilization.

Section 706 was not entered into the U.S. Code in 1996, when the rest of the Telecommunications Act of 1996 was. In 2008, Congress enacted an amendment to Section 706 and it was codified. The Broadband Data Improvement Act listed a series of findings about the impact of broadband, which was the motivation to improve the quality and frequency of the FCC's analysis of broadband deployment under Section 706.

> The Congress finds the following:
>
> (1) The deployment and adoption of broadband technology has resulted in enhanced economic development and public safety for communities across the Nation, improved health care and educational opportunities, and a better quality of life for all Americans.
>
> (2) Continued progress in the deployment and adoption of broadband technology is vital to ensuring that our Nation remains competitive and continues to create business and job growth.
>
> (3) Improving Federal data on the deployment and adoption of broadband service will assist in the development of broadband technology across all regions of the Nation.
>
> (4) The Federal Government should also recognize and encourage complementary State efforts to improve the quality and usefulness of broadband data and should encourage and support the partnership of the public and private sectors in the continued growth of broadband services and information technology for the residents and businesses of the Nation.

The following year, the Congress authorized funds to develop programs to accelerate the deployment of broadband in the Broadband Technology Opportunities Act. It also charged the FCC with developing a National Broadband Plan. The substantive issues to be included, reflect the earlier findings of the Broadband Data Improvement Act.

> The national broadband plan required by this section shall seek to ensure that all people of the United States have access to broadband capability and shall establish benchmarks for meeting that goal. The plan shall also include—
>
> (A) an analysis of the most effective and efficient mechanisms for ensuring broadband access by all people of the United States;

> (B) a detailed strategy for achieving affordability of such service and maximum utilization of broadband infrastructure and service by the public;
>
> (C) an evaluation of the status of deployment of broadband service, including progress of projects supported by the grants made pursuant to this section; and
>
> (D) a plan for use of broadband infrastructure and services in advancing consumer welfare, civic participation,
>
> public safety and homeland security, community development, health care delivery, energy independence and efficiency, education, worker training, private sector investment, entrepreneurial activity, job creation and economic growth, and other national purposes.
>
> (3) In developing the plan, the Commission shall have access to data provided to other Government agencies under the Broadband Data Improvement Act (47 U.S.C. 1301 note).

The Broadband Technology Opportunity Program directly references the Broadband Data Improvement Act.

The issues that were raised by these two Acts are at the heart of the "virtuous cycle" and they go well beyond the 20th century approach to universal service. Availability of service is a small part of universal service in the digital age; adoption and utilization are much more important.

2. The Failure of the Information Service Classification to Achieve the Goals of the Act

As noted above, the sixth Section 706 Report evaluating the deployment of broadband was the first issued after the Broadband Technology Opportunities Act. It was the first report to find that deployment of broadband was not timely and reasonable. This is a change in circumstances of considerable significance. Thus, after more than a decade, the classification of broadband as an information service has failed to achieve the primary goal of the Act. A decade may not seem like a long time, but in cyberspace, it is an eternity. In fact, it is twice as long as the period in which broadband was not classified as an information service. In a sense, the telecommunications service classification was never tried.

This legislative activity and empirical analysis presents a new context in which both the urgency of implementing Section 706 and the opportunity to revisit Title II are magnified.

VII. TITLE II

There are two ways in which Title II authority can be asserted – classifying new telecommunications services as Title II services or reclassifying broadband Internet access service as a telecommunications service. In both cases, the argument is that developments since the decision to classify broadband Internet access service as an information service compel the Commission to revisit that decision given it responsibility to pursue the goals of the Act.

A. CHANGED CIRCUMSTANCES SINCE THE ORIGINAL DECISION TO CLASSIFY BROADBAND AS AN INFORMATION SERVICE

Changed circumstances will play a large part in endeavoring to impose Title II authority on part or all of broadband Internet access service. In a dynamic space, the change of circumstances should not be surprising. Does it rise to the level of the need for a new classification of broadband?

The analysis of changed circumstances must start from the original decision to classify broadband as an information service. A good case can be made that the decision to classify high speed data transmission was weak, if not fundamentally flawed on law, technology, economics and policy. Developments since then have highlighted the weaknesses.

Law: The Commission reversed long-standing Commission precedent on the basis, in part, of the assumption that it had sufficient authority through the well-established precedent of exercising ancillary authority which gave it the ability to exercise Title II-type authority over non-Title II service. That assumption has proven tenuous at best, wrong at worst. While it can be argued that section 706 authority replaces ancillary authority in important ways, as defined by the D.C. Appeals Court, it does not come close to giving the Commission access to the regulatory tools that ancillary authority did.

Technology: The Commission claimed that certain technical and economic attributes of the bundles of broadband Internet access and information services that network owners were offering to the public made it inappropriate to classify broadband as a telecommunication service. The integration attributes that the Commission cited as justification for not treating the broadband component of the bundle (or the entire bundle) as a telecommunications service, were always doubtful. Today they no longer apply, if ever they did. Indeed, the ongoing disputes with the edge companies underscore the fact that these are standalone services in little need of technological integration.

Economics: The Commission based its decision on the expectation that competition particularly from new technologies and new entrants (e.g. broadband over powerlines) would develop and restrict the potential abuse of market power. That projection proved utterly false. Again, the development of the need for high volume, high quality data transmission that has triggered the disputes between edge companies and network owners make it clear that there are few service providers capable of provision networks to meet the needs of the edge companies.

Policy: The Commission recognized that the decision to break with precedent and classify broadband Internet Access service as an information service would have a very significant impact on all of the goals of the Communications Act that are set out in Title II. It opened proceedings to deal with these concerns, but made its classification decision without the benefit of the insights from those proceedings. In fact, those proceeding were never completed.

Ironically, the progress made toward establishing a new regulatory approach shines a spotlight on gaps that exist in the authorities the Commission has in pursuing the goals of the National Broadband Plan without Title II authority. The call for a transition to an all IP network magnifies the problem of inadequate authority.

Beyond the open Internet concerns, Section 254 and 706 authority leave challenging questions about how to implement universal service funding (which falls under Title II) to promote broadband. Section 255, which seeks to ensure communications functionality serves the needs of American's with disabilities also falls into a grey area.

B. New Telecommunications Services

Services that were non-existent or played a very small role at the time of the decision to classify broadband as an information service now make a very important contribution to the communications network in ways that may merit the classification as a telecommunications service. Interconnection with private telecommunications facilities and new telecommunications functionalities provided by Internet based-services provide telecommunications infrastructure and promote competition in exactly the manner the 1996 hoped.

In the case of these services, the Information service classification can be an impediment to their contribution because they may be denied interconnection or their telecommunications capability is not recognized. These service can also important to advance the "virtuous cycle" since they constitute innovation at the edge.

The identification of new telecommunications services could be implemented broadly. The transmission of any edge company sending data to a consumer would be considered a telecommunications service. It could be done narrowly, identifying specific functions or facilities used in the delivery of the requested data.

Interestingly, the D.C. Appeals Court ruling on the Open Internet Order lays the groundwork for such an approach.[88] It draws a distinction between a retail customer who requests data from an edge company and the response, which transmits the data to the consumer. Not only are the acts logically distinguishable, but they are also likely to be very different. As

[88] Tejas N. Narechania and Tim Su, *Ex Parte RE; GN docket No. 14-28,* April 9, 2014.

discussed above, the request for data uses very little bandwidth, the response can use a great deal.

C. Reclassifying Broadband Internet Access Service

Invoking these changed circumstances, one can argue that reclassifying broadband service is necessary. The Commission is allowed to change its mind. The D.C. Circuit Appeals Court has recently allowed the FCC to change its mind with respect to section 706. The Supreme Court's decision to uphold the FCC classification of broadband as an information service reversed two Appeals Court rulings on the grounds of Chevron deference. If the law is deemed to be sufficiently ambiguous to allow the FCC's interpretation; it is would seem to be sufficiently ambiguous to allow the alternative classification. An examination of the legal status of the classification of high speed data certainly indicates it was a close call (see Exhibit VII-2). However, reclassifying broadband Internet access service as a Title II service may not be a simple answer to the problem of bright lines. It does not automatically fill the gaps. The FCC must conclude that specific practices are unjust, unreasonable and unduly discriminatory to ban them under Title II.

Even under Title II regulation large and small users were treated quite differently. Many of the same facts that would have entered into the evaluation of negotiated arrangements will be put into the Title II regulatory proceeding. There were numerous classifications of service frequently based on the amount of communications. Large customers had access to specialized services and even individualized (private line) services. There were instances where large business customers paid for the service that would typically be paid for by small, residential customers.

EXHIBIT VII- 1: A CLOSE CALL, REGULATORY AND JUDICIAL TREATMENT OF MASS-MARKET, HIGH-SPEED DATA TRANSMISSION

Year	Event	Implications for Current Classification Review
1998	Stevens Report	Ambiguous on Classification
1998	Public Interest Groups Petition for Title II Classification	Need for Nondiscrimination demonstrated
2000	*Portland v. AT&T Cable*: 9th Circuit Court of Appeals finds cable modem service involves telecommunications is subject to Title II	Title II Classification asserted
2000	FTC imposes commercial access condition on AOL-Time Warner	Concern about bottleneck provider expressed
2002	FCC issues Cable Modem Declaratory Order classifying it as an information (not telecommunications) service.	Classified Information Service; Title I Authority Asserted, Need to address Communications Act principles affirmed
2003	*Brand X v. FCC* – 9th Circuit Court of Appeals affirms its *Portland v. AT&T* and overturns Cable Modem order	Information Service rejected; telecommunications affirmed
2004	Chairman Powell declares Four Internet Freedoms	Importance of Non-discrimination, Consumer protection affirmed
2005	FCC uses Title II authority to investigate undue discrimination by Madison River	Importance of Non-discrimination affirmed
2005	Supreme Court reverses 9th Circuit (6-3) on procedural grounds and upholds FCC information service classification	Information service upheld, Justices debate Title I authority
2005	FCC extends the Information service definition to mass market, speed data transmission services offered by telephone companies.	high- Title I authority claimed; Need to address Communications Act principles affirmed
2005	FCC turns Four Internet Freedoms into a policy statement	Importance of Non-discrimination, Consumer protection affirmed
2006	AT&T agrees to network neutrality Bell South merger condition	Ability to distinguish service demonstrated
2007	FCC finds Comcast illegally discriminated against peer-to-peer applications.	Need for non-discrimination affirmed Technical ability to offer separate services demonstrated
2010	Open Internet Proceeding initiated	Need for Non-discrimination stated, Title I authority asserted
2010	National Broadband Plan	Importance of Communications Act principles affirmed Failure to achieve Communications Act goals documented
2010	D.C. Appeals Court overturns FCC action against Comcast	Title I authority questioned
2010	Broadband Internet Access Notice of Inquiry	Recognizes important of all Communications Act principles
2010	Sicth Section 706 Report	Documents failure to achieve goals of the Act
2014	Open Internet Order	Section 706 authority upheld, implementation vacated.

Title II standards are imprecise even after three quarters of a century of regulatory practice and case law. In our initial comments in this proceeding we argued that the "looseness" of the language was the way Congress dealt with a challenge in the regulation of telecommunications. The underlying technology has always been more dynamic than the law and this has become overwhelmingly apparent in the digital era. Drawing bright lines before the fact will provide greater certainty once the rulemakings and litigation are done. Therein lies the rub.

D. The Fit between Utility Regulation and Digital Innovation Systems

Moreover the general approach to utility-common carrier regulation is challenging from the point of view of the Internet innovation system and the "virtuous cycle."

Utility/common carrier (Title II) regulation is about homogeneity and stability. It thrives in static environments and, inevitably, reinforces the stasis of the environment because it operates best by creating silos with categories of producers and consumers, definitions of acceptable behavior, and permissions required to act. These service categories and "does" and "don'ts" are hashed out in administrative proceedings and court cases that can stretch out for years or even decades. The cost of delay can be ignored because the sector is so static.

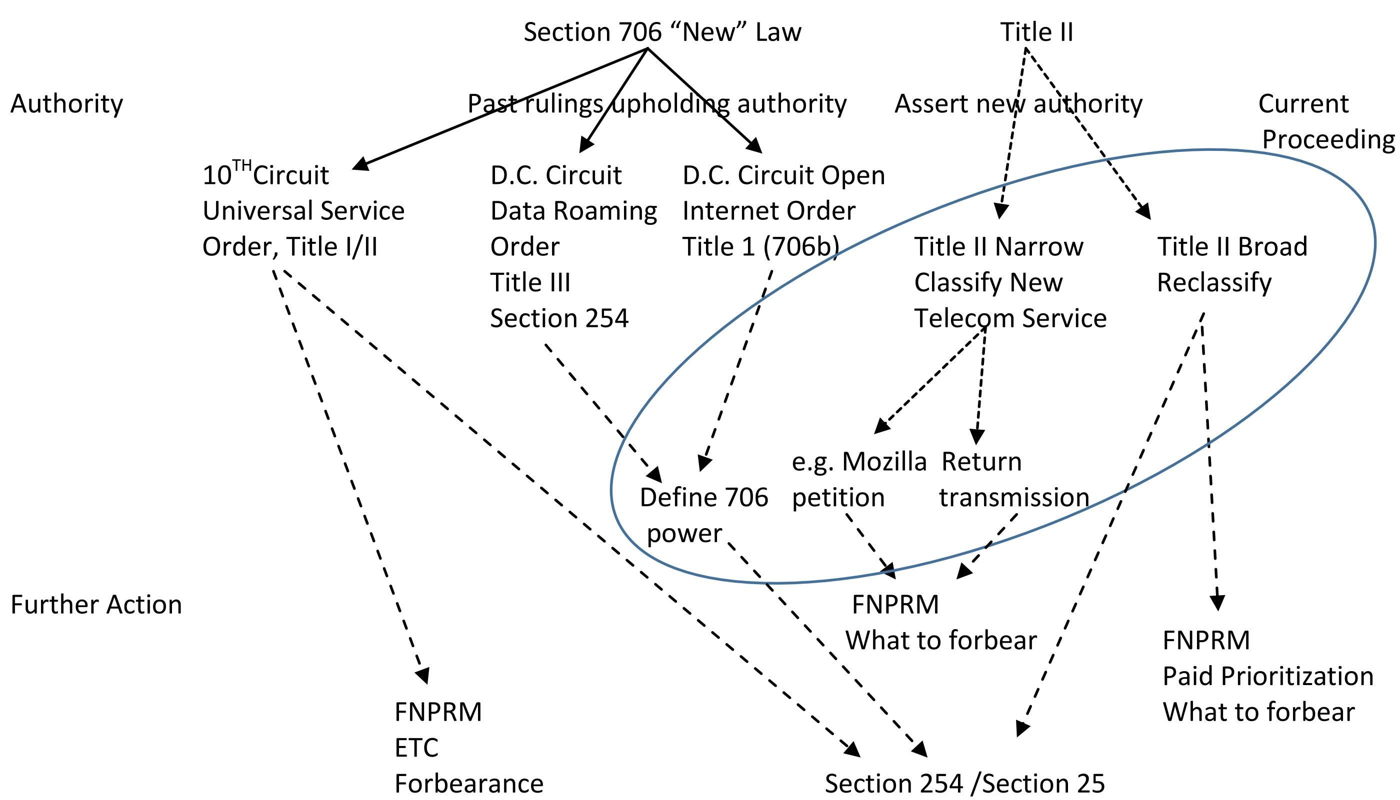
Digital communications networks are the antithesis of common carrier telecommunications networks. They thrive on diversity and prosper only where dynamic change is the key to success. The essence of utility regulation is antithetical to the experimentation, innovation and entrepreneurship that has been the hallmark of the digital economy. In a dynamic environment, the costs of delay and the value of lost services – innovation that is never brought to market – are severe. Greenstein's description of how experimentation worked makes this point clear, "because nothing precluded this unanticipated use from growing, grow it did… The growing use of Wi-Fi raised numerous unexpected technical issues about interference, privacy, and rights to signals. Nevertheless, they did not slow Wi-Fi's growing popularity?" In the utility-common carrier approach, everything is precluded until it is permitted and problems immediately end up at the Commission for adjudication. "Brutally simple" bright lines that opened the way to entrepreneurial behavior are what worked in the past, not detailed regulation of behavior.

The extent to which the Commission chooses to invoke Title II authority adds complexity, but the underlying terrain is already complex (see Exhibit VII-1). Further notices will be necessary under any circumstances.

- Fleshing out the rules and norms under the 706 approach will inevitably require additional proceedings. Not surprisingly, T-Mobile has asked the Commission to do so under the Data Roaming Order.
- The same would certainly be true if the Commission determines that there are new types of telecommunications services that need to be classified as Title II (e.g. the Mozilla petition, the edge company response, or interconnection for new private facilities added to the communications infrastructure).
- Reclassification of broadband would require proceedings to determine what will be regulated and how, including a blizzard of forbearance requests from network owners. As noted earlier, "institutional change" is slower than economic change and technically and culturally complex.

Thus, this analysis also suggests why the use of Title II authority should be selective and targeted. The Communications Act gives it the flexibility to do in the form of regulatory forbearance (section 10). This does not mean that bright line cannot be drawn, it means they much be carefully drawn. The FCC needs to implement the substance of process of network neutrality that fits the economic reality of the digital economy.

EXHIBIT VII-2: COMPLETING THE REGULATORY STRUCTURE OF THE 1996 ACT



APPENDIX A:
THE LONG HISTORY AND INCREASING IMPORTANCE OF PUBLIC-SERVICE PRINCIPLES FOR 21ST CENTURY PUBLIC DIGITAL COMMUNICATIONS NETWORKS

MARK COOPER*

INTRODUCTION

The day after the 2012 presidential election, AT&T filed a petition asking the Federal Communications Commission (the "FCC" or "Commission") to consider how telecommunications would be regulated under the Communications Act of 1934 (the "1934 Act") as the architecture of the communications network is transformed from primary reliance on analog technology and copper wires to digital technology and fiber optic cable. This has become known as the "sunset" of the public switched telecommunications network ("PSTN").

Less than six months later, in response to Hurricane Sandy, Verizon announced that it would not repair the copper telephone wires that the storm had destroyed on Fire Island. Instead, it proposed to use a wireless, digital service to provide basic telephone service. This triggered an intense debate, as many in the community objected to what was perceived to be a significant reduction in the quality of service. The New York State Attorney General strenuously opposed the move, and public interest groups demanded a full proceeding.[1]

What AT&T is asking for and Verizon sought to implement is a dramatic change in the policies and principles that had governed the communications network for over 100 years; a change that is tantamount to administrative repeal of the public-service principles at the heart of the 1934 Act. This paper shows that the change is unwarranted and unnecessary. Rather than abandon the public-service principles that have successfully guided the U.S. telecommunications sector, history, law, policy, technology, and economics all suggest that the commitment to these principles should be affirmed and the scope of the principles expanded in the age of digital communications.

Section I identifies the six public-service principles that have guided telecommunications policy in the U.S. in the long history of the development of transportation and communications networks in the capitalist era. Section II shows that pseudo-access competition in communications and transportation networks does not support the public-service principles. These principles must be imposed and enforced externally to ensure that these vital infrastructure industries support economic development and democratic discourse in the polity. Section III reviews the legal grounds on which the Commission can ensure that the public-service principles that have guided the successful deployment of the PSTN in the twentieth century transfer into the public digital communications network ("PDCN") that is rapidly becoming the dominant means of communication in the twenty-first century.

---

* Journal of Telecommunications and High Technology Law, 12, Spring 2014

1. Emergency Petition of New York Attorney General Eric T. Schneiderman for an Order Preventing Verizon from Illegally Installing Voice Link Service in Violation of its Tariff and the Commission's May 16, 2013 Order, No. 13-C-0197 (N.Y. Pub. Serv. Comm. June 27, 2013), *available at* http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={A3F0A269-8613-4437-AEB3-35ACCF6E5A47}.

I. PUBLIC-SERVICE PRINCIPLES IN THE TRANSPORTATION AND COMMUNICATIONS SECTORS[2]

A. The Origin of the Principle of Activities that are "Affected with the Public Interest"

The legal principle that some activities constitute a public service and therefore incur obligations in the way they are offered to the public stretches back to the mid-fourteenth century. Over the ensuing centuries, the specific activities that are considered to be "affected with the public interest" and the nature of the obligations have varied.[3] One area where the march of history has consistently been to strengthen and expand public-service principles, however, has involved the means of communication and commerce.[4]

> Although the original economic reasons for the idea of a "common" calling disappeared, the concept underwent an important transformation . . . . [S]ometime during the latter part of the seventeenth century, most trades began to do business generally with the public. Accordingly, the idea of a common calling began to lose significance in most kinds of businesses. Certain kinds of businesses, however, most notably common carriers by land and water and innkeepers, were treated differently. This treatment marks the beginning of the idea of a public service company.[5]

Reflecting this historical and legal pattern of development, discussions that deal with the public-service principles that govern telecommunications services and attach to telecommunications service providers reach back to the eighteenth century. They point to how the common-law dealt with services that were provided in the transportation sector. A mid-eighteenth century Blackstone commentary described the principle as it applied to innkeepers:

> [I]f an inn-keeper, or other victualler, hangs out a sign and opens his house for travelers [sic], it is an implied engagement to entertain all persons who travel that way; and upon this universal assumpsit, an action on the case will lie against him for damages, if he without good reason refuses to admit a traveler.[6]

A 1701 court decision that used the blacksmith as an example offered similar reasoning:

> Whenever any subject takes upon himself a Publick [sic] Trust for the Benefit of the rest of his fellow Subjects, he is . . . bound to serve the Subject in all the Things that are within the Reach and Comprehension of such an Office . . . . If on the Road a Shoe fall off my Horse, and I come to a Smith to have one put on and the Smith refuse to do it, an Action will lie against him, because he has made Profession of a trade which is for the Publick Good . . . . One that has made Profession of a Publick Employment is bound to the utmost Extension of that Employment to serve the Publick.[7]

---

2. *See generally* Mark Cooper, From the Public Switched Telephone Network to the Public Digital Communications Network: The Role of Interconnection, Interoperability, Universal Service and Innovation at the Edge in the Digital Revolution (Feb. 10, 2013) (unpublished manuscript), *available at* http://www.fordham.edu/images/undergraduate/communications/cooper%20interconnection%201-26-13.pdf.

3. ALAN STONE, PUBLIC SERVICE LIBERALISM: TELECOMMUNICATIONS AND TRANSITIONS IN PUBLIC POLICY 29 (1991).

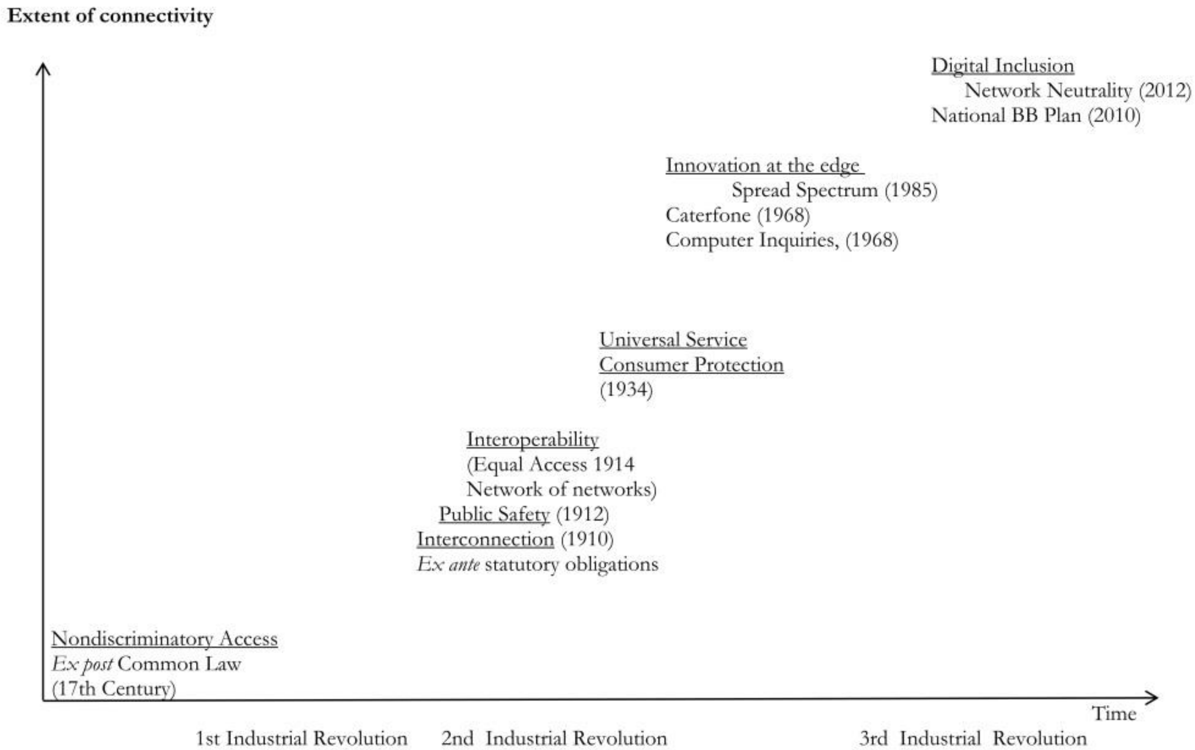
4. *See* EXHIBIT I-1, *infra*.

5. STONE, *supra* note 3, at 29-30.

6. 3 WILLIAM BLACKSTONE, COMMENTARIES *164, *cited in* James B. Speta, *A Common Carrier Approach to Internet Interconnection*, 54 FED. COMM. L. J. 225, 254 n. 142 (2002).

7. Lane v. Cotton, 12 Mod. 472, 484 (1701), *cited in* STONE, *supra* note 3, at 30.

EXHIBIT I-1: THE PROGRESSIVE EVOLUTION OF PUBLIC-SERVICE PRINCIPLES IN THE COMMUNICATIONS SECTOR



It is important to note that, while activities that were associated with transportation, like innkeepers and blacksmiths, incurred the public-service obligation under common-law, the underlying transportation facilities actually incurred even stronger obligations under statute.[8] Navigation projects, canals, and turnpike trusts, chartered under obligations of providing service to the public, were the early vehicles of the emerging capitalist political economy to provide for transportation infrastructure.[9] Created in the fifteenth through eighteenth centuries, and building on principles of common-law, these were private undertakings with a public franchise to collect tolls on the section of a road or waterway whose upkeep was the responsibility of the franchise holder as a trustee for the public. Fees were assessed and access provided on a nondiscriminatory basis. While different rates could be charged to different types of traffic, discrimination within categories was forbidden.[10]

Thus, it is historically correct to say that the principle of nondiscriminatory access to the means of

8. *Turnpike Trusts*, WIKIPEDIA (Jan. 31, 2014, 3:38 AM), http://en.wikipedia.org/wiki/Turnpike_trusts.

9. Mark N. Cooper, *Making the Network Connection: Using Network Theory to Explain the Link Between Open Digital Platforms and Innovation*, *in* OPEN ARCHITECTURE AS COMMUNICATIONS POLICY: PRESERVING INTERNET FREEDOM IN THE BROADBAND ERA 95, 111-12 (Mark N. Cooper ed., 2004); Andrew Odlyzko, Pricing and Architecture of the Internet: Historical Perspectives from Telecommunications and Transportation (Aug. 29, 2004) (unpublished manuscript), *available at* http://www.dtc.umn.edu/~odlyzko/doc/pricing.architecture.pdf.

10. Odlyzko, *supra* note 9.

communications and commerce has been part of the DNA of capitalism since its birth. It is analytically important to make this statement strong and broad because the movement of goods and ideas is essential to the success of the capitalist economy and the democratic polity.[11] As capitalism was dissolving feudalism, the emerging social order discovered an important new social, political, and economic function: mobility. Physical and social mobility were anathema to feudalism but essential to capitalism and democracy. Providing for open and adequate highways of commerce and means of communications were critical to allow commerce to flow, to support a more complex division of labor, and to weave small, distant places into a national and later global economy. This principle came to the new world with the Anglo-Saxon settlers who ultimately dominated the American continent.[12]

B. The Preservation and Extension of Public-service principles for the Transportation and Communications Sectors in the Industrial Era

With the rate of economic change accelerating throughout the industrial era, pressures mounted on the institutional legal structure that governed nondiscriminatory access to the means of communications and commerce. By the late nineteenth century, direct public responsibility for roads, as opposed to franchise trusts, became the norm and provided nondiscriminatory access.[13] Maintaining a network of transcontinental roads became a governmental responsibility, first city, then state, then national.[14] Other means of communications and commerce, railroad, canals, telegraph, telephone, tended to remain in private hands with substantial public support and public service obligations.[15]

The institutional structure grappled with the emerging industrial mode of production throughout the nineteenth century, as the nature and scale of economic activity changed. Public service obligations on the means of communications and commerce increased.

> It was originally supposed that [the railroads] would add, and . . . they have added, vastly, and almost immeasurably, to the general business, the commercial prosperity, and the pecuniary resources of the inhabitants of cities, towns, villages, and rural districts through which they pass, and with which they are connected. It is, in view of these results, the public good thus produced, and the *benefits thus conferred upon the persons and property of all the individuals composing the community,* the courts have been able to pronounce them matters of public concern.[16]

Here there is an interesting contrast between England and the U.S. In England, the common-law approach allowed central authority to expand rapidly, moving beyond regulation to nationalization.[17] In the U.S., common-law was cabined by constitutional law. Expanding the scope of central authority required much more compelling evidence to fit within constitutional constraints. It was only when the expanding economy and increasingly complex division of labor drove interstate commerce to the heart of the economy that the federal role could expand.[18] It did so by the end of the nineteenth century.[19]

Moreover, in a typical American pattern, the Interstate Commerce Act did not spring *sui generis* into

---

11. Cooper, *supra* note 9.

12. STONE, *supra* note 3, at 17 (noting that things might have been very different if the French and Indian Wars had gone the other way).

13. *Turnpike Trusts*, *supra* note 8.

14. *History of Turnpikes and Canals in the U.S.*, WIKIPEDIA (Jan. 27, 2014, 2:40 PM), http://en.wikipedia.org/wiki/History_of_turnpikes_and_canals_in_the_United_States.

15. *Id.*

16. Olcott v. Supervisors, 83 U.S. 678, 692 (1872), *cited in* STONE, *supra* note 3, at 35 (emphasis original).

17. Mark Cooper, *Why Growing up is Hard to Do: Institutional Challenges for Internet Governance in the "Quarter-life Crisis" of the Digital Revolution*, 11 J. ON TELECOMM. & HIGH TECH. L. 45 (2013).

18. *Id.*

19. *Id.*

existence. The field had been well plowed by the states in the American federalist system, which had been grappling with and extending their oversight over the burgeoning industrial economy.[20] State promotion and regulation of canals and railroads began in the mid-nineteenth century and progressed steadily over the course of the century.[21] More local utility services—water, gas, electricity, telephone—were promoted and regulated at the municipal level.[22]

The important role of state and local activity in the development of the uniquely American institutional approach to public-service principles should not be overlooked. Not only was the legal field plowed at the state and local levels, but a significant public sector was built up to deliver local services in a variety of contexts where the regulated private sector had failed to live up to the public-service expectations.[23] While electronic communications have been predominantly privately owned in America, there has been a substantial local public sector for a number of utility services, with electricity having one of the larger sectors. The institutional diversity was important.[24]

By the end of the nineteenth century, as the Second Industrial Revolution pushed the scale and complexity of the economy to a much higher level and spilled across state borders, law and practice had paved the way for the institutionalization of public service obligations.[25] The evolving relationship between the private firms delivering these uniquely public services and the state and local governments had laid the foundation for the federalization of this policy

The railroads, which had become the dominant means of commerce and communications in the nineteenth century, were the focal point of economic and legal activity. The recognition of the importance of the railroads was the basis for the extension of public-service principles:

> The railroad, as an improved means of communication and transportation, has produced indescribable changes in all the manifold transactions of every-day life which go to make up what is called commerce. Successful commerce brings prosperity, which in turn makes possible the cultivation and development of the graces and attributes of the highest civilization.[26]

The positive contribution of the railroads to economic progress was the primary justification for imposing public service obligations, but the harmful effects of failing to provide service on a nondiscriminatory basis was the proximate cause of a more direct and aggressive enforcement of the public service obligation on carriers.[27] The Cullum Commission Report outlined the immense benefit of the railroads, explored the interstate nature of commerce, recounted state efforts to deal with railroad abuses and recommended national legislation to address a lengthy list of complaints.[28]

Electronic communications entered the picture in the mid-nineteenth century and rapidly joined the railroads as a critically important public service infrastructure.[29] The state courts that had been grappling

20. *Progressive Era,* WIKIPEDIA (Mar. 26, 2014, 3:13 AM), http://en.wikipedia.org/wiki/Progressive_era.

21. Odlyzko, *supra* note 9.

22. *Id.*

23. STONE, *supra* note 3, at 159.

24. John E. Kwoka Jr., *The comparative advantage of public ownership: evidence from U.S. electric utilities,* 38 CANADIAN J. ECONOMICS/REVUE CANADIENNE D'ÉCONOMIQUE, 622–640 (2005), *available at* http://onlinelibrary.wiley.com/doi/10.1111/j.0008-4085.2005.00296.x/abstract (discussing the benefits of public power); Andrew Stirling, *On the Economics and Analysis of Diversity* (Univ. Sussex Sci. Police Research Unit, Working Paper No. 28, 2000), *available at* http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.144.8865&rep=rep1&type=pdf (discussing the broader role of diversity).

25. STONE, *supra* note 3.

26. S. REP. No. 49-46, at 4 (1886).

27. STONE, *supra* note 3, at 31-38.

28. S. REP. No. 49-46, at 180.

29. Kwoka, *supra* note 24; Stirling, *supra* note 24.

directly with the new means of communications and commerce drew strong analogies between transportation and communications.[30] A quote from *Hockett v. State,* an 1886 Indiana court case links the past to the present:

> [The telephone] has become as much a matter of public convenience and of public necessity as were the stagecoach and sailing vessel a hundred years ago, or as the steam-boat, the railroad, and the telegraph have become in later years. It has already become an important instrument of commerce. No other known device can supply the extraordinary facilities which it affords. It may therefore be regarded, when relatively considered, as an indispensable instrument of commerce. The relations which it has assumed towards the public make it a common carrier of news, – a common carrier in the sense in which the telegraph is a common carrier, – and impose upon it certain well-defined obligations of a public character. All the instruments and appliances used by a telephone company in the prosecution of its business are consequently, in legal contemplation, devoted to a public use.[31]

This quote captures the long history of the concept of public obligation that attached to services that play the vital role of supporting the flow of commerce and communications. The early date of this observation, 1886, is notable, since the telephone had just begun to be adopted.[32] Traditional practice did not excuse it from public service obligations because it was new. The quote points to several transportation carriers—stagecoaches, sailing vessels, and steamboats—that were not infrastructure industries and were likely competitive but still were required to shoulder public service obligations. Thus, competition did not excuse important activities from the public-service principles, reminding us that it is the nature of the service, not the conditions of supply that creates the pubic obligations. This citation also suggests the dual nature of communications networks as both a means of commerce and a means of democratic expression.

Interestingly, the above legal characterization came the year before the passage of the first piece of progressive federal legislation, the Interstate Commerce Act, which underscores the clear shift in the approach to nondiscrimination that was about to take place. The quarter century after the Interstate Commerce Act saw the creation of a federal, statutory basis for direct oversight over the public-service principles in the railroad industry; these principles were extended to electronic communications, by the enactment of the Mann-Elkins Act of 1910, which placed interstate telecommunications under the Interstate Commerce Act,[33] stating: "[n]ow the telegraph line and the telephone line are becoming rapidly as much a part of the instruments of commerce and as much a necessity in commercial life as the railroad."[34]

C. The Expansion of the Public-service principles during the Quarter-life Crisis of the 2nd Industrial Revolution

Hockett, decided in 1886, and the other activities around nondiscriminatory access and the expanding concept of public-service principles (identified in Exhibit I-1) all took place in a period that we have called the quarter-life crisis of the Second Industrial Revolution,[35] which spans the Progressive Era and the New Deal.[36] What we see in those policy changes is the adoption of a new approach to ensuring that important traditional principles are preserved as the dominant mode of production in a changing society. This is the moment when the mode of production that is rising to dominance and maturing is asked to shoulder the burdens of social goals and public aspirations that are deeply embedded in society. And, in a progressive

30. *See, e.g.*, Hockett v. State, 5 N.E. 178 (Ind. 1886), *cited in* Speta, *supra* note 6, at 262 n. 187.
31. *Id.*
32. BUREAU OF THE CENSUS, U.S. DEP'T COMMERCE, HISTORICAL STATISTICS OF THE UNITED STATES: COLONIAL TIMES TO 1970, PART 2 784 (1975) (penetration of the telephone in 1886 was 2.9 telephones per 1000 people in the United States).
33. *Mann-Elkins Act*, WIKIPEDIA (Feb. 19, 2014, 6:13 PM), http://en.wikipedia.org/wiki/Mann-Elkins_Act.
34. 45 CONG. REC. 5,534 (1910), *cited in* STONE, *supra* note 3, at 33.
35. Cooper, *supra* note 17.
36. *See* EXHIBIT I-2, *infra*.

society, it is the moment to move those social goals to a higher level.

The response to the maturation challenges of the Second Industrial Revolution went well beyond simply reaffirming the importance of and commitment to nondiscriminatory access (see Exhibit I-2). The Progressive Era approach to nondiscrimination exhibited other important characteristics that indicate a new, more far-reaching approach, as discussed below. The following are the key characteristics that public-service principles were to embody in the twenty-first century:

EXHIBIT I-2: LIFE CYCLE OF INDUSTRIAL REVOLUTIONS[37]

Invention	**Date**	**Political Turmoil**	**Primary Mass Communications**
1st Industrial Revolution			
Flying Shuttle	**1733**		
Cotton Mills	**1742**		
Water Frame	**1764**		
Spinning Jenny	**1765**		
Steam Engine	**1769**		
Steam Ship	**1775**	**Age of**	
Threshing Machine	**1784**	**Revolution**	
Power Loom	**1785**	**1775**	
Cotton Gin,	**1793**		
Interchangeable Musket Parts	**1798**		
Steam Locomotive	**1804**	**Luddism**	
Steamboat Service on the Hudson River	**1807**		
Typewriter	**1829**		
Telegraph, revolver	**1836**		**Penny Press**
Sewing Machine	**1844, 1851**	**1848**	**Telegraph**
	1860s		**Photography**
2nd Industrial Revolution			
Bessemer Steel	**1855**		
Synthetic Dye	**1856**		
Machine Gun	**1862**		
Transatlantic Cable, dynamite	**1866**		
Modern Typewriter	**1867**		
Tungsten Steel	**1868**		
Barbed Wire	**1873**		
Telephone	**1876**		
Phonograph,	**1877**		**Telephone**
Incandescent Light bulb	**1879**	**Progressive Era**	
Induction Electric Motor	**1888**	**State**	
Diesel Engine	**1892**	**Regulation**	
Radio	**1901**		
Airplane	**1903**		
Model T Ford, Assembly Line	**1908, 1913**		**Radio**
	1930s	**New Deal**	
	1940s		**Television**
3rd Industrial Revolution			
Transistor	**1947**		
Integrated Circuit	**1958**		
Micro Computer	**1968**	**Caterfone/**	
Internet	**1969**	**Computer Inquiries**	
Microprocessor, E-mail	**1971**		
Modem	**1997**		
PC-IBM	**1980**		
Commercial Internet	**1986**		
Commercial Wireless Service	**1984**		
WorldWideWeb	**1991**		
ISOC	**1992**	**CALEA, DMCA,**	
	1996	**Telecom Act**	**Broadband**
	1998	**ICANN**	
	1999	**COPA,**	
	2000		**YouTube**
	2003	**WSIS**	
	2004		**Social media**
	2012	**SOPA.PIPA**	

37. Cooper, *supra* note 17.

1) It shifted from *ex post* to *ex ante* regulation of nondiscrimination.[38]

2) It layered oversight across sector specific regulation and general antitrust law.[39]

3) It introduced the concept of equal access between network operators, thereby highlighting the fact that society was becoming a network of networks—a concept that the digital revolution would take to a much higher level.[40]

The latter point deserves emphasis. The economic value of interconnection and interoperability of networks in a continental economy was compelling. One-and-a-quarter centuries ago, in one of the first and most important acts of the Progressive Era at the federal level, the United States adopted the Interstate Commerce Act, which shifted the nation from an *ex post*, harm-based theory of nondiscrimination under common-law to an *ex ante*, prophylactic theory of nondiscrimination under sector-specific law.[41] The approach was first applied to the railroads, the dominant means of transportation.[42] Twenty-five years later and in spite of the promises of AT&T executives, Vail and Kingsbury,[43] the new approach to public-service principles was extended by statute and statutory enforcement to electronic telecommunication.[44] Private carriers were to provide nondiscriminatory access as a matter of law; individuals did not have to prove they had been harmed by the denial of service.[45]

The Progressive Era not only shifted from *ex post* to *ex ante* oversight of nondiscriminatory electronic communications, it layered public *ex ante* and *ex post* oversight on the industry. Some of the most important federal actions in the telecommunications space have been initiated by the Department of Justice ("DOJ") under the Sherman Act, not the FCC and its predecessor agencies, including the consent decree of 1914, the final judgment of 1956, and the modification of final judgment in 1984.[46]

Moreover, while the Sherman Act is overwhelmingly based on an *ex post*, harm-based approach, one extremely important exception involves business conduct that threatens to fundamentally alter the market structure to the detriment of competition.[47] In merger review under the Clayton Act, the DOJ routinely acts in an *ex ante*, prophylactic manner, blocking mergers that raise significant competitive concerns.[48] At roughly the same time, legislation explicitly gave the sector-specific federal regulatory agency oversight over telecommunications mergers.[49] In the 1934 Act, Congress required the FCC to review mergers under a much broader public interest standard than the DOJ applies.[50] Thus, *ex ante* regulation at the FCC, including merger review, is reinforced by *ex ante* merger review at the DOJ and backstopped by *ex post* regulation at the DOJ.

The quintessential expression of the expanding public-service principles and obligations of the carriers

---

38. Mann-Elkins Act, ch. 309, 36 Stat. 539 (1910).

39. The Sherman Act and the Interstate Commerce Act apply to interstate commerce. *See* Sherman Act, 15 U.S.C. §§ 1-7 (2013); Interstate Commerce Act, 49 U.S.C. §§ 1-80504 (1994).

40. United States v. Am. Telephone &Telegraph Co., 552 F. Supp. 131 (D.D.C. 1982), *aff'd* Maryland v. United States, 460 U.S. 1001 (1983).

41. It is more than mere historical coincidence that the U.S. railroad system achieved full, national standardization at exactly this moment. *See Standard Gauge*, WIKIPEDIA (Oct. 30, 2013, 3:58 PM), http://en.wikipedia.org/wiki/Standard_gauge.

42. *Id.*

43. *A Brief History: The Bell System*, AT&T, http://www.corp.att.com/history/history3.html (last visited Mar. 29, 2014).

44. 47 U.S.C. § 251 (2013).

45. *Id.*

46. ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS 140-45, 295-306 (1988).

47. *See* Sherman Antitrust Act, 15 U.S.C. §§ 1-7 (2013).

48. Clayton Antitrust Act, 15 U.S.C. §§ 14-19 (2013).

49. STONE, *supra* note 3, at 193, 201 (pointing out that the Interstate Commerce Commission was inserted and the DOJ removed from merger review by the Willis Graham Act from 1920 to 1934, when the dual jurisdiction was created).

50. ADVISORY COMM. ON PUB. INTEREST OBLIGATIONS OF DIGITAL TELEVISION BROADCASTERS, THE PUBLIC INTEREST STANDARD IN TELEVISION BROADCASTING (1998), *available at* http://govinfo.library.unt.edu/piac/novmtg/pubint.htm.

who make up the PSTN is the 1934 Act. In its first sentence, the purpose is defined as follows:

> [T]o make available, so far as possible, to all people of the United States a rapid, efficient nationwide and world-wide wire and radio communications service with adequate facilities at reasonable charges, for the purposes of national defense, for the purpose of promoting safety of life and property through the use of wire and radio communications, and for the purpose of securing a more effective execution of this policy by centralizing authority heretofore granted by law to several agencies and by granting additional authority with respect to interstate and foreign commerce in wire and radio communications.[51]

The commitment was broad and pragmatic, involved wired and wireless communications, and recognized the centrality of communications to a number of social goals. The definition of the goals was inclusive and evolutionary, and the commitment to the form of governance was secondary to the statement of goals. It chose the form of governance that dominated the response to the quarter-life crisis of the Second Industrial Revolution—expert agency regulation—but regulation is for the purpose of achieving the goals, not as an end in itself. The public-service principles broadly stated in the first paragraph of the Act are then given specificity in later titles of the Act, as suggested by Exhibit I-3. The arrows in the exhibit show how the broad goals of the Act stated in the first sentence are given elaborate in the specific language in the sections of Title II.

D. The Increasing Need for Public-service principles in the Electronic Communications Sector of the 2nd Industrial Revolution

Is all this concern about nondiscrimination, integration, universal service, etc., in communications necessary? 400 years of experience suggested to Progressive Era policymakers that it was. The shift from *ex post* to *ex ante* and the layering of regulation of integration was driven by two factors, both very much akin to the underlying forces that drove the broader progressive movement, as summarized in Exhibit I-4 and discussed below.

51. 47 U.S.C. § 151 (1996).

EXHIBIT I-3: TITLE I GOALS AND TITLES II AND III TOOLS OF THE COMMUNICATIONS ACT

EXTENSION OF LINES

(a)…No carrier shall discontinue, reduce or impair service to a community, unless and until there shall first have been obtained from the Commission a certificate that neither the present nor future public convenience and necessity will be adversely affected thereby…
(d) The Commission may after full opportunity for hearing, in a proceeding upon complaint or its own initiative without complaint, authorize or require by order any carrier, party to a proceedings, to provide itself with adequate facilities or require for the expeditious and efficient performance of its services as a common carrier and to extend its line…

UNIVERSAL SERVICE

S. 254 (b) Universal Service Principles – The Joint board and the Commission shall base policies for the preservation and advancement of universal service on the following principles:

(1) Quality and Rates –Quality services should be available at just reasonable, and affordable rates. (2) Access to Advanced Services – Access to advanced telecommunications and information services should be provided in all regions of the nation.

S. 254 (c) (1) Universal service is an evolving level of telecommunications service that the Commission shall establish periodically under this section, taking into account advances in telecommunications and information technologies and services. The Joint Board in recommending, and the Commission in establishing definitions of the services that are supported by Federal Universal service support mechanisms shall consider the extent to which such telecommunications services

(a) are essential to education, public health or public safety; (b) have, through the operation of market choices by customers, been subscribed to by a substantial majority of residential customers; (c) are being deployed to public telecommunications networks by telecommunications carriers; and (d) are consistent with the public interest, convenience and necessity.

ACCESS FOR PERSONS WITH DISABILITIES

225: In order to carry out the purpose established under section 1 … the Commission shall ensure that interstate and intrastate communications relay services are available, to the extent possible and in the most efficient manner, to hearing-impaired and speech-impaired individuals in the United States.
255: A provider of telecommunications service shall ensure that the service is accessible to and usable by individuals with disabilities, if readily

TITLE I

For the purpose of regulating interstate and foreign commerce in communications by wire and radio so as to make available, so far as possible, to all people of the United States a rapid, efficient nationwide and world-wide wire and radio communications service with adequate facilities at reasonable charges, for the purposes of national defense, for the purpose of promoting safety of life and property through the use of wire and radio communications…

PUBLIC SAFETY

229: The Commission shall prescribe such rules as are necessary to implement the requirements of the Communications Assistance for Law enforcement Act… shall include rules to implement Section 105.... that require common carriers to require appropriate authorization to activate interception of communication or access to call-identifying information and to prevent any such interception or access without such authorization…The Commission shall review the policies and procedures.... and shall order a common carrier to modify any such policy or procedures that he Commission determines does not comply
Title III: It is the propose of this Act...to maintain control of the Unites States over all the channels of radio transmission… No person shall use or operate any apparatus for the transmission of energy or communications… except under and in accordance with this act and with a license in that behalf granted and under the provision of this Act.

INTERCONNECTION AND CARRIAGE

201: It shall be the duty of every common carrier… to establish physical connections with other carriers… through routes and charges… and provide facilities and regulations for operating such through routes… All charges, practices, classifications, and regulations for and in connection with such communications service shall be just and reasonable…
202: It shall be unlawful for any common carrier to make nay unjust or unreasonable discrimination in charges, practices, classifications, regulations, facilities or services for or in connection with like communications service, directly or indirectly.... or to make or give any undue or unreasonable preference…or to subject any particular person, class of persons or locality to any undue or unreasonable prejudice or disadvantage.
251: Interconnecting: (a) General Duty of Telecommunications Carriers – Each telecommunications carrier has the duty—(1) to interconnect directly or indirectly with the facilities and equipment of other telecommunications carriers; and (2) not to install network features, functions or capabilities that do not comply with the guidelines and standards established…

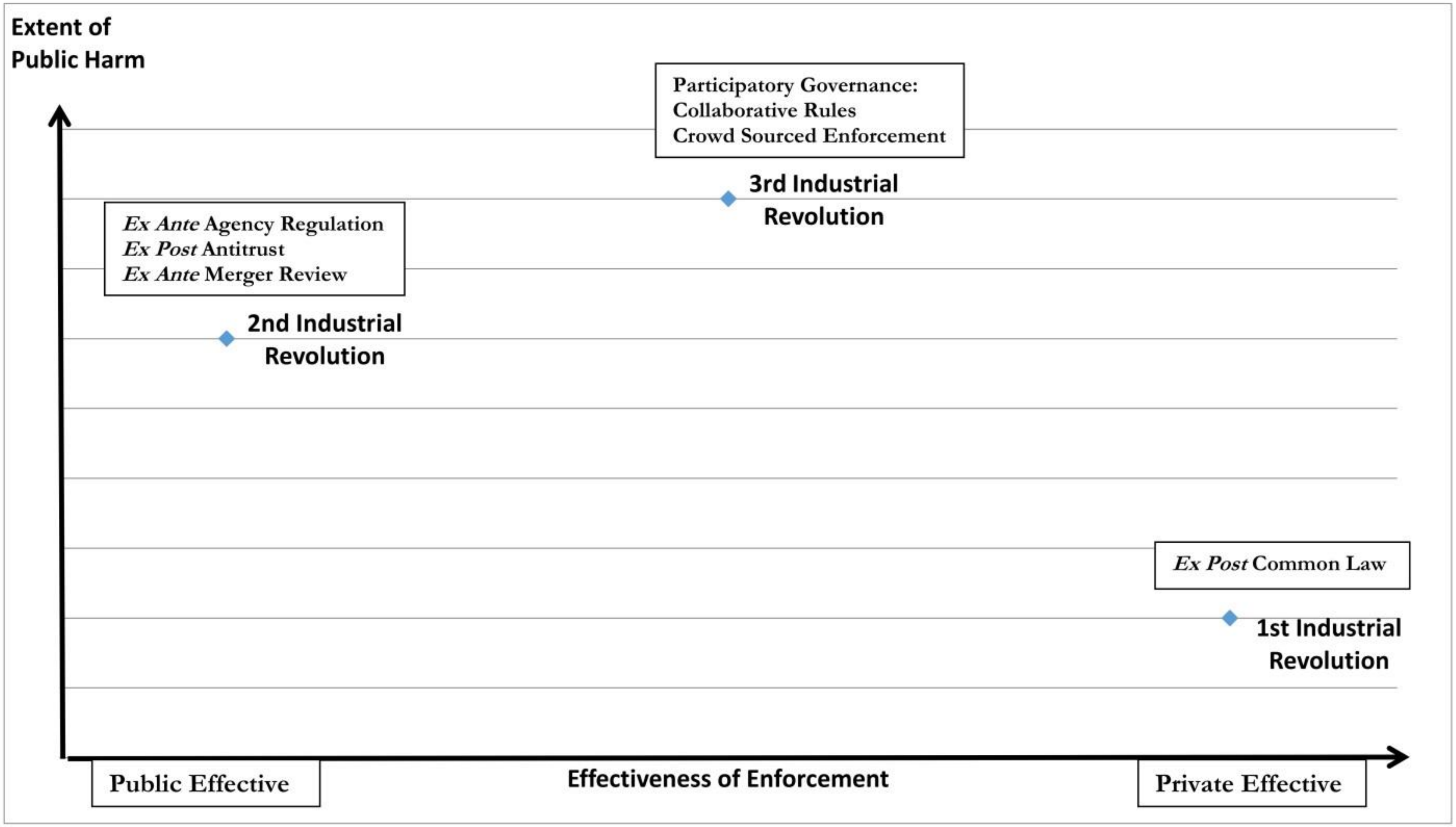
CONSUMER PROTECTION

258: No telecommunications carrier shall submit or execute a change in a subscriber's selection of a provider of telephone exchange services or telephone toll service except in accordance with such verification procedures as the Commission shall prescribe.

PRIVACY

222: Every telecommunication carrier has a duty to protect the confidentiality of proprietary information of, and relating to other telecommunications carriers... and customers

Exhibit I-4: Economic Conditions Dictate the Nature of Effective Enforcement



First, the importance of interconnection had grown as the division of labor became more complex, and the scope of the economy expanded. Alfred Chandler, a preeminent American economic historian, described the vital role of transportation and communications in the expansion of the economy during the Second Industrial Revolution as follows:

> But of far more importance to the expansion of the factory system was the reliability and speed of the new transportation and communication. Without a steady, all-weather flow of goods into and out of their establishments, manufacturers would have had difficulty in maintaining a permanent working force and in keeping their expensive machinery and equipment operating profitably. Moreover, the marketing revolution based on the railroad and the telegraph, by permitting manufacturers to sell directly to wholesalers, reduced requirements for working capital and the risk of having unsold goods for long periods of time in the hands of commission merchants. Reduced risks and lower credit costs encouraged further investment in plant, machinery and other fixed capital.[52]

Stone ties Chandler's observation back to Adam Smith through the important role that transportation and communications play in supporting the more complex division of labor:

> In short, the division of labor, as Adam Smith observed, is limited by the extent of the market. And the extent of the market is limited, in turn, by the speed, reliability, and cost of communications. Rapid and extensive communications, thus, radically transform production as well as distribution[.]
>
> The telegraph, in short, was not simply another new invention. Virtually every economic activity was significantly affected . . . . Although its commercial capabilities were not recognized in the nations of Europe (with the exception of Great Britain), the telegraph in the United States was, together with the railroad, critical in the development of national markets.[53]

Second, key changes in society created a need for a change in the mechanisms for enforcing the public-service principles. The ability of individuals to exercise their rights to nondiscriminatory access had been obliterated by the massive increase in size and power of the dominant owners of the means of communications and commerce.[54] The suggestion that private individuals could effectively assert their rights under common-law when confronted with massive corporate power and resources, not to mention the legal expertise of the newly created corporate general counsels invented by the railroads was not very credible. As stated bluntly by the Cullum Committee Report, "[t]he Common-law fails to afford a remedy for such grievances."[55]

While the focus of attention has traditionally been on the economic factors and forces, the social bases of public-service principles should also be recognized. Important social values have been involved including provision of necessities, appropriate standards of living, the ability to participate in modern life, and equality of opportunity.[56] Universal service and consumer protection can be seen as principles that bridge the social and economic dimensions.[57] Just as the economic dimension of public

52. ALFRED D. CHANDLER, JR., THE VISIBLE HAND: THE MANAGERIAL REVOLUTION IN AMERICAN BUSINESS 245 (1977), *cited in* STONE, *supra* note 3, at 25.

53. STONE, *supra* note 3, at 25-26.

54. *An Act to Regulate Commerce: Hearing on S. 2851 before the Senate*, 50th Cong. (1888) (statement of Sen. Shelby Cullom, Chairman, Comm. on Interstate Commerce).

55. *Id.*

56. STONE, *supra* note 3, at 24, 36.

57. *See generally* Mark N. Cooper, *Inequality In The Digital Society: Why The Digital Divide Deserves All The Attention It Gets*, 20 CARDOZO ARTS & ENT. L. J. 73 (2002); Mark Cooper, *The Digital Divide Confronts the Telecommunications Act of 1996: Economic Reality versus Public Policy*, *in* THE DIGITAL DIVIDE: FACING A CRISIS OR CREATING A MYTH? (Benjamin M. Compaine ed., 2001); Mark Cooper, *Universal Service: A Constantly Expanding Goal*, *in* NEW MILLENNIUM RESEARCH COUNCIL, CONSUMER

service obligations expanded, the broader social values have expanded as well, underscoring the progressive nature of expanding public-service principles.

Thus, the economic costs and social injustice of the uneven enforcement of the private right to nondiscrimination that would result from massive corporations pursuing their private interests under common-law had become too great for society to tolerate. Policy turned to a broader set of multi-layered public-service principles imposed by regulation to enforce a broader right of access and achieve a higher level of integration. Simply put, the means of communications had become so important to the progress and practice of capitalism and democracy that, at the moment of ascendance of the Second Industrial Revolution, they were deemed sufficiently vital to merit both *ex ante* and *ex post* oversight that takes into consideration its "merely commercial aspect[s]" *and* its broadly sociopolitical impacts.[58]

E. The Quarter-life Crisis of the 3rd Industrial Revolution

The contemporary debate over the public-service principles and obligations of the PSTN is taking place at roughly the same point in the lifecycle of the 3rd Industrial Revolution, as shown in Exhibit I-2 above. Digital communications have become the dominant means of communications. We are living through the quarter-life crisis of the digital revolution and we ask how it will shoulder its new responsibilities across a dozen or more important social issues. Today, we confront exactly the same questions that society grappled with in the maturation of the Second Industrial Revolution. Should public-service principles apply to the means of communications in the twenty-first century? Does it merit this close scrutiny?

History, law, economics and policy make the answer to these questions an emphatic "YES."[59] If anything, the commitment should be even stronger and the scrutiny closer in the twenty-first century political economy.

The convergence of communications and commerce, the increasing importance of communications in economic, social, and political life, and the more dynamic, interconnected nature of the digital economy means the failure of integration can impose greater harm than ever.[60] All of the key, economy-enhancing characteristics that Chandler attributes to the railroad and the telegraph in the middle of the nineteenth century certainly apply to digital communications technologies at the beginning of the twenty-first century with greater force.[61] Specifically:

- For some products that can take a purely digital form, digital technologies reduce or eliminate the need for physical distribution networks, which can cut the cost of the delivered goods and services by more than one-half.
- For many physical goods and services, digital technologies transform the production

PERSPECTIVES ON UNIVERSAL SERVICE: DO AMERICANS LOSE UNDER A CONNECTION-BASED APPROACH? 6 (2003); Mark Cooper, *Broadband in America: A Policy of Neglect is not Benign*, *in* OVERCOMING DIGITAL DIVIDES: CONSTRUCTING AN EQUITABLE AND COMPETITIVE INFORMATION SOCIETY (Enrico Ferro et al. eds., 2009).

58. Associated Press v. United States, 326 U.S. 1, 28 (1945).

59. The consumer-friendly and citizen-friendly nature of the Internet was evident early on in its development. *See* MARK COOPER, EXPANDING THE INFORMATION AGE IN THE 1990S: A PRAGMATIC CONSUMER VIEW (1990).

60. The importance of digital technology and the digital communications revolution is widely recognized. *See* Cooper, *supra* note 17. An approach that ties this to the issue of access to infrastructure can be found in BRETT M. FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES (2012).

61. *See* Mark Cooper, *Structured Viral Communications: The Political Economy and Social Organization of Digital Disintermediation*, 9 J. ON TELECOMM. & HIGH TECH. L. 15 (2011); Mark Cooper, *From Wi-Fi to Wikis and Open Source: The Political Economy of Collaborative Production in the Digital Information Age*, 5 J. ON TELECOMM. & HIGH TECH. L. 125 (2006); Mark Cooper, *The Economics of Collaborative Production in the Spectrum Commons*, *in* NEW FRONTIERS IN DYNAMIC SPECTRUM ACCESS NETWORKS 379-400 (2005); Mark Cooper, Collaborative Production in Group-Forming Networks (Oct. 21, 2005) (unpublished manuscript), *available at* http://www.citi.columbia.edu/conferences/stateoftelecom/cooper.pdf.

process.

- For all products, digital technologies lower transaction costs and dramatically reduce the need for inventory by ensuring a closer (in some cases perfect) fit between what is produced and consumed.
- Even more importantly, digital technologies empower and facilitate innovation by the users of the network on a pervasive basis, supporting a dramatic and unique transformation of the division of labor.
- Of equal or greater importance, the increase in citizen participation in political discourse made possible by the new means of communications can enrich democracy.

Because of the increasing public benefits of the seamless flow of information and data, more than in the past, the harm of failing to adhere to the public-service principles is greater and the inability of *ex post* action to remedy it is magnified. In a decentralized economy one never knows from where innovation will come or how important it will be.[62]

In a profoundly interconnected society that has become a highly recursive system, with dynamic, real-time networks, discrimination can be devastating to rapidly evolving, highly interconnected activity.[63] In digital networks, discrimination can be subtle, but potent. With a small number of critical choke points that possess a great deal of vertical leverage and the ability to extract massive rents, thereby wasting important resources, the incentive and ability to discriminate in these networks is strong.[64]

The case for the *ex ante* public service obligation is at least as strong when it comes to non-economic issues. As digital networks become the dominant means of communications and expression, the exercise of political rights becomes dependent on access to and the flow of information over those networks. Where basic rights are involved, "replacement" dictates that the right is not diminished as the medium of political discourse changes, but also expands on the new networks. In light of the importance and power of digital communications networks, I argue it makes even less sense to rely on *ex post* regulation than it did a century and a quarter ago when it was abandoned by progressive era policy makers.

However, in making the case for the increased importance of the public-service principles on the basis of the dynamic, recursive nature of the digital age, I also lay the foundation for arguing that the approach to imposing and enforcing the public-service principles must evolve as well.[65] More than 500 years of history teach that regulated common carriage is not synonymous with public-service principles and obligations. On the contrary, for three-quarters of the history of capitalism in the Anglo-American world, nondiscrimination was enforced by common-law, so we should be open to alternative ways of ensuring nondiscrimination in the digital economy, even though we reject the *ex post* approach.

The lesson is not that we need to impose the expert agency model exactly as it was during the Second or Third Industrial Revolutions. Rather, the lesson is that the public-service principles need to be preserved, even expanded, to support the high level of performance of a networked society and

62. Cooper, *Structured Viral Communications*, *supra* note 61; Cooper, *From Wi-Fi to Wikis and Open Source, supra* note 61.

63. Mark Cooper, *The Importance of Open Networks in Sustaining the Digital Revolution*, *in* NET NEUTRALITY OR NET NEUTERING: SHOULD BROADBAND INTERNET SERVICES BE REGULATED 109 (Thomas M. Lenard & Randolph J. May eds., 2006); Mark N. Cooper, *Anticompetitive Problems of Closed Communications Facilities in* OPEN ARCHITECTURE AS COMMUNICATIONS POLICY: PRESERVING INTERNET FREEDOM IN THE BROADBAND ERA 155 (Mark N. Cooper ed., 2004); MARK COOPER, CABLE MERGERS AND MONOPOLIES: MARKET POWER IN DIGITAL MEDIA AND COMMUNICATIONS NETWORKS (2003).

64. *See* Mark Cooper, *Antitrust As Consumer Protection in the New Economy: Lessons from the Microsoft Case*, 52 HASTINGS L.J. 813 (2001).

65. Cooper, *supra* note 17, at 56.

implemented with a form of regulation that best supports the functioning of the new mode of production. The form of regulation needs to fit the nature of the networks and develop as they do. The digital communications sector requires a more flexible, dynamic *ex ante* approach to ensuring the implementation of the public-service principles. Indeed, as I argue in the next section, it was a decision to replace the common carrier approach with a more flexible, less intrusive policy that created an environment that was uniquely favorable to the birth and growth digital revolution in communications.

II. PSEUDO-ACCESS COMPETITION AND UBIQUITOUS, SEAMLESS INTEGRATION OF INFRASTRUCTURE NETWORKS

As we have seen, competition (or the lack thereof) does not determine whether public-service principles govern an activity and impose obligations on service providers.[66] The state of competition is a factor that should be examined, particularly in the current policy context, where one goal of public policy is to promote competition. In this context, the question of whether public policy can simply rely on competition to ensure the principles will inevitably arise. As discussed in the next section, the 1996 amendments to the Communications Act provide specific standards for answering this question. Here I examine how access competition affected interconnection in various circumstances in several industries in the U.S.

A. The Evil Empire vs. the Benevolent Despot, or something in between

The events of the early competitive period in the U.S. telephone sector are fairly well agreed upon. Their interpretation and meaning are not. Two primary theories are offered to explain the integrated, near-national monopoly that developed. In one view, it was the result of AT&T's nefarious strategy to end competition, using the promise of interconnection to convince regulators not to impose severe restraints and to later allow acquisition of the independent providers (the "Independents").[67] From the other view, AT&T saw the benefits of an integrated national monopoly and embraced a policy of natural monopoly that was consistent with the underlying economics and the public interest.[68]

After the expiration of the Bell patents, a short intense period of construction of independent phone networks occurred, mostly in areas where AT&T did not to provide service.[69] Competition in long distance service was much weaker. As shown in Exhibit II-1, at the height of the competitive period, 'Independent' accounted for over 40% of all telephone subscribers. During this period, however, 13% of all telephone subscribers (mostly businesses) had service from dual networks.

---

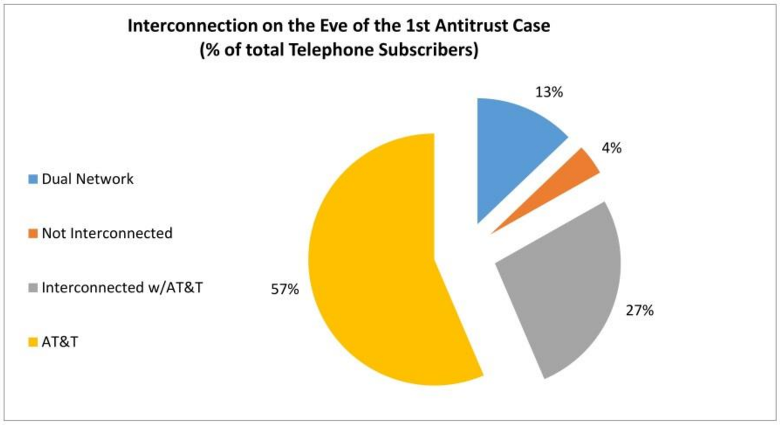
66. STONE, *supra* note 3, at 31.

67. *See e.g.,* SUSAN P. CRAWFORD, CAPTIVE AUDIENCE: THE TELECOM INDUSTRY AND MONOPOLY POWER IN THE NEW GILDED AGE (2014); MILTON MUELLER, UNIVERSAL SERVICE: COMPETITION, INTERCONNECTION, AND MONOPOLY IN THE MAKING OF THE AMERICAN TELEPHONE SYSTEM (1997); STONE, *supra* note 3; BREAKING UP BELL: ESSAYS ON INDUSTRIAL ORGANIZATION AND REGULATION (David S. Evans & Robert Bornholz eds., 1983).

68. *See e.g.,* CRAWFORD, *supra* note 67; STONE, *supra* note 3.

69. The beneficial effect of the expiration of the patent, which afforded open access to the underlying technology, is another example of the beneficial effect of the principle discussed in this paper. The fact that the Constitution embodies the great suspicion of monopoly both reflects the intellectual tradition of the framers and the uniquely American approach.

EXHIBIT II-1: TELEPHONE SUBSCRIPTION AND INTERCONNECTION PATTERNS IN THE COMPETITIVE ERA[70]



Initially AT&T refused to interconnect with independent networks, but as pressures mounted, they reversed course.[71] Thus, in 1900 only 4% of independent lines were interconnected; by 1905, 13% of independent phone subscribers were served by independent companies that interconnected with AT&T; by 1910, the number had risen to 53%; and, in 1920 it was 84%. The pressures came from the Independents, who needed access to a long distance network to provide service that could compete with AT&T; from local businesses, who disliked the need for dual service; and from local regulators who saw duplication as wasteful and the denial of interconnection as harmful to local interests.[72]

The dominant carrier, AT&T, agreed to interconnect as part of a strategy that intended to restrict competition.[73] The Independents had difficulty agreeing to interconnect with one another, particularly to build an independent long distance network to compete with AT&T, which would have greatly enhanced their ability to become viable, long-term competitors with AT&T.[74] Interconnection with AT&T came at a price. AT&T asserted control over quality and imposed the condition that termination of calls in areas where AT&T faced a competitor had to be on the AT&T-affiliated local exchange. In other words, AT&T used its dominant position in long distance as vertical leverage to advantage its local services.[75]

As the states grappled with the problem of lack of interconnection, federal policymakers took notice. It was during the competitive-era that state regulation was imposed on local telephone companies. One of the causes being the need for dual-service, and one of the consequences being the elimination of competition.[76] From the peak of access competition with over 40% of subscribers being to non-AT&T companies (and 55% of all service territories, since the Independents tended to serve smaller towns and rural areas) the Independents shrank to 18% by 1965.[77]

70. MUELLER, *supra* note 67; STONE, *supra* note 3. Percentages are calculated assuming dual networks involve subscribers to AT&T local and an independent.

71. *See infra* EXHIBIT II-2.

72. STONE, *supra* note 3, at 160.

73. *Id.* at 130-40, 179-80, 186-91, 199-204 (charting the economic difficulties of the independents and their inability to form an arrangement that would let them build a second long distance network).

74. *Id.*

75. *Id.*

76. *Id.* at 158-64; *See infra* EXHIBIT II-3.

77. BUREAU OF THE CENSUS, *supra* note 32, at 783.

EXHIBIT II-2: INDEPENDENT LINES INTERCONNECTED WITH AT&T[78]

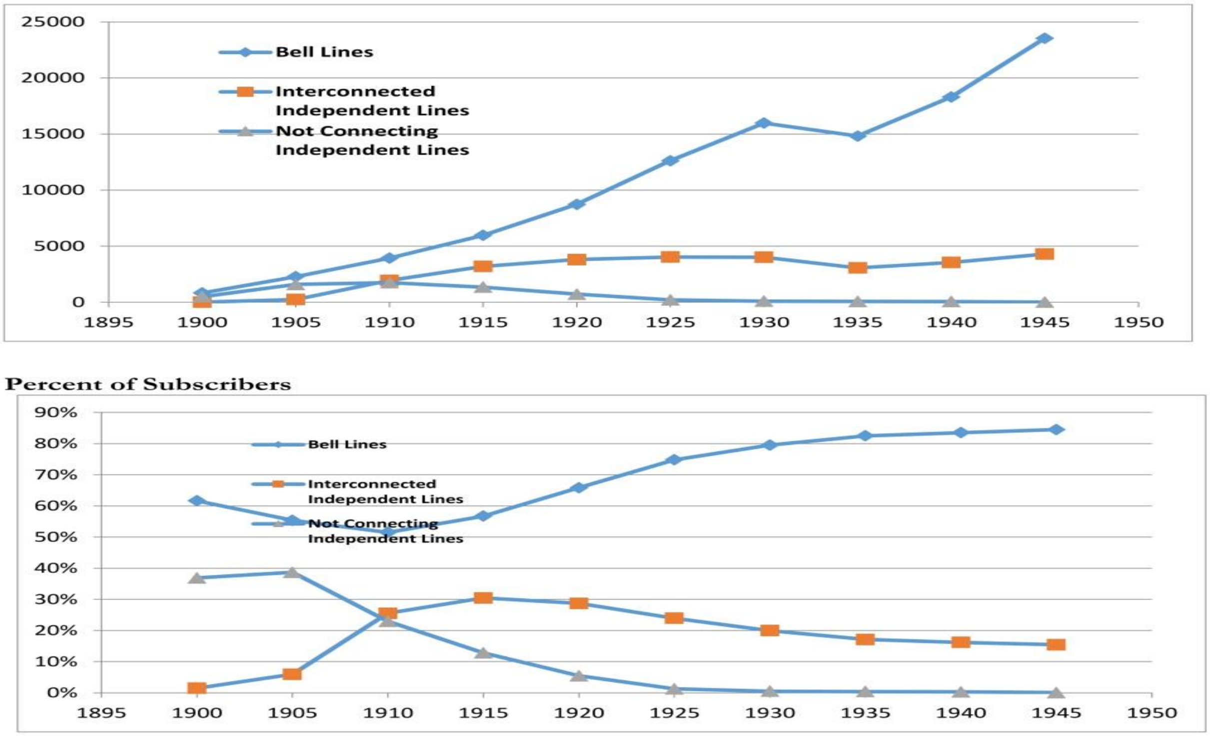
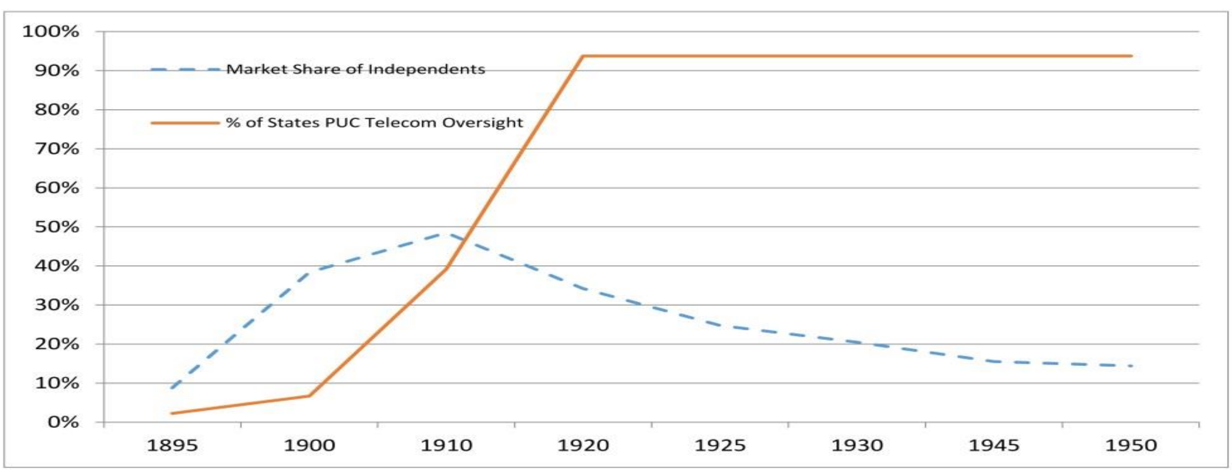


EXHIBIT II-3: COMPETITION AND REGULATION[79]



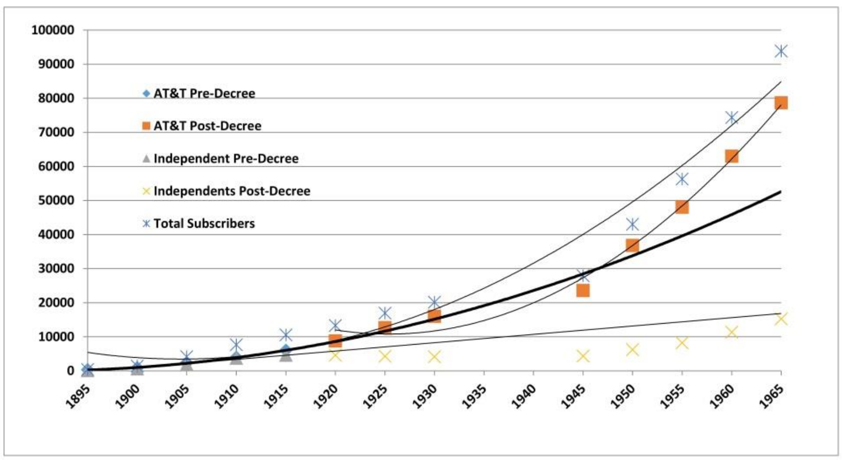
78. *Id.*
79. STONE, *supra* note 3; BUREAU OF THE CENSUS, *supra* note 32, at 783.

It is difficult to see much difference in the growth of subscribership between the competitive and the post-competitive periods, although the institutional changes make it difficult to sort out "causality." The co-linearity of important variables means the competing explanations persist and drive analysts toward qualitative historical accounts.[80] To be sure, the entry of Independents extended telephone service to areas where AT&T had chosen not to go but generally avoided head-to-head competition. Ultimately, growth under the monopoly models looks quite like growth during the competitive period. Competition did not affect subscription to promote universal service.

B. Pseudo-Access Competition does not Lead to Ubiquitous, Seamless Network Integration

The period of access competition did not produce interconnection. Advocates of competition argue that the problem was that there was not enough competition, so the Independents still saw their subscriber base as a source of local market power to be exploited. If there had been more competition, the theory goes, the Independents would have realized the futility of separate networks and shared the benefits of interconnecting.

EXHIBIT II-4: SUBSCRIBER GROWTH COMPETITIVE PERIOD AND AFTER (000 SUBSCRIBERS)[81]



The competing telephone companies, as the discussion above demonstrates, failed to interconnect because there was too little competition rather than too much competition. These companies tried to use local exchanges as strategic bottlenecks in developing telephone systems.[82]

In this theory, the competitive access approach to interconnection requires not only a sufficient number of viable competitors to eliminate the allure of exploiting the local monopoly; it also requires vertical separation between local and long distance and vigorous antitrust oversight to prevent collusion.

> Separating the exchanges from the companies (or associations) providing long distance might have fostered interconnections and prevented the Bell system from establishing a monopoly over the national telephone system. Lacking any system-building incentives, local exchanges would have had strong incentives to either interconnect with each other or interconnect with a common-long distance company. There is no reason to believe that local exchange would have foregone these opportunities

80. *See infra* EXHIBIT II-4.

81. BUREAU OF THE CENSUS, *supra* note 32, at 783.

82. Robert Bornholz, *The Early History of Competition in the Telephone Industry*, *in* BREAKING UP BELL: ESSAYS ON INDUSTRIAL ORGANIZATION AND REGULATION 33 (David S. Evans & Robert Bornholz eds., 1983).

> for mutually advantageous trades. This policy would have maintained a quasi-competitive local exchange market and, perhaps, a quasi-competitive long-distance market. On the other hand, the incentive to collude between competitive local exchanges and between local exchanges and long-distance companies might have required vigilant oversight over such an industry.[83]

The question is not whether there is a range on the supply curve where marginal costs are rising, but how many competitors are sustainable when that scale has been reached. The question of economic viability of competitors becomes critical.[84] Less than a decade after the consent decree required AT&T to interconnect and provide equal access to its long distance network, the competing firms that were identified in the decree were on the brink of bankruptcy as the result of destructive competition in which rates were driven to non-compensatory levels. Those firms asked the court to lift the decree so they could merge.[85] The Independents were too small to survive, but too big to be convinced that they should give up their local market power to join an integrated national network. The policy sweet spot of access competition is extremely small and the goal of "quasi-competition" is not all that attractive.

The challenge of finding this policy sweet spot is particularly difficult where there are multiple potential sources of vertical leverage and monitoring complex behavior is particularly difficult. Not only must policy hope that minimum efficient scale will support enough competition to induce integration, but it must prevent vertical integration across a number of linked products and police collusion.

Faced with this improbable scenario in which access competition can be relied on (in part) to yield interconnection, an alternative approach is to argue that ubiquitous, seamless integration is no longer desirable. Mueller argued that demand-side economies of scale and advancing technologies change the policy terrain, as shown by his observation that integration is "no longer an unqualified good, as it may have been in the era of Vail."[86] With technological change "in the present environment, it is easier to achieve various levels or gradations of compatibility and interconnection. Thus, it is unlikely that users will be confronted with the stark choice between interconnection and no interconnection they faced in the past."[87]

Underlying this alternative view of interconnection are hypotheses about technology and consumer demand.

> As fears about privacy and security grow, and technologies such as voice mail and caller ID gain popularity, one can only conclude that today's users are as interested in controlling and restricting

---

83. *Id.*

84. MUELLER, *supra* note 67 (arguing that supply side economies of scale are less important than people thought, citing statements by industry executives and findings that marginal costs are rising. Mueller depicts the supply curve as one with only slightly rising marginal costs. However, he misses the fact that there is a wide range of production in which the average costs are falling. The important question for competition is not simply whether marginal costs are rising or falling, but whether the minimum efficient scale in the industry is small enough to support vigorous competition. If it is not, then the industry will not be vigorously competitive. He does recognize that current network economics may indicate the industry is in a range of declining cost, which makes competition difficult).

85. STONE, *supra* note 3, at 131-135 (arguing that comparative analysis of market performance in areas before, during, and after competition across time, as well as between areas with and without competition, leave the claims for the superiority of competition, at a minimum, in doubt).

86. MUELLER, *supra* note 67, at 187.

87. *Id.* (one final point made by Mueller is important. He notes that the way we use the concept of universal service today is quite different that the one used by Vail in 1908, although the concept as used in 1934 is closer to contemporary usage. Mueller is right about Vail, who intended it as a commitment to interconnection, which is important. But the fact that the public service obligations of communications and transportation carriers have evolved over the course of half a millennium is not the insult that Mueller seems to think it is. Because his analysis is ahistorical, seeking to derive lessons for interconnection policy today by focusing on the short period of access competition, which lasted for only a couple of decades in a history that is approaching six hundred years, he vastly overstates its potential. The public service obligations evolve in a progressive manner over time, an evolution that has accelerated with the acceleration of technological progress. It is a fact of life, not a mistake of analysis).

access as they are in broadening it. To many people, the indiscriminate intrusion of a universal "information superhighway" into their home or business is about as welcome as the presence of an eight-lane interstate highway in their backyard.

The typical business card today carries three or four different user addresses – one each for a telephone, a cellular phone, a fax and an electronic mail address, or a pager. There may be additional information about internal, enterprise networks. Compared to that, the advertisements of the dual service era, in which businesses had to list two different telephone numbers, seem simple. . . . Indeed, a large number of users now have two incompatible and unconnected "telephones" on their desk. One is the traditional voice telephone connected to the PSTN, the other is a computer equipped with Internet voice transmission software.

It is possible that technological and institutional difference between the past and the present have tilted the social optimum away from integration and toward more tolerance of heterogeneity, fragmentation, and competition.[88]

The argument is based on several dubious assumptions. Heterogeneity and competition at the application layer does not require fragmentation at the physical layer. At the time these observations were offered, the Internet almost certainly rode on the PSTN. In that sense, they were not "incompatible and unconnected." In short order, Voice over Internet Protocol ("VOIP") rendered the two completely compatible and connected. It is the incumbents who have historically resisted interconnection and interoperability, that have blocked it on occasion, and would certainly like to change the terms and conditions of interconnection in the digital age.

The value of ubiquitous seamless integration lies in the optionality of group formation, which argues that the value of the communications network does not lie in who you did talk to, but to whom you could talk.[89] The problem is that the subgroups of consumers who would like to talk to each other are hard to know in advance, and the choices of subscribers with whom one wants to communicate may not be static. [90] With whom you want to talk may change over time. That option value has grown dramatically in the digital age and is reduced by fragmentation of networks. Designing networks that cater to individual consumer needs is difficult and would result in severe fragmentation. This ignores the transaction costs of knowing which service reaches which customers and suppliers.

The tsunami of data and the sharing of information on social media suggest that users value access a great deal more than they value restriction of access. Users would certainly like more control of their data, but they clearly want to have and use access.

C. Deregulated Network Industries do not Embrace Seamless Integration

Infrastructure network industries in other circumstances without regulated integration suggest that seamless integration is not an outcome to be expected in the marketplace.[91] The inclination to use local

---

88. *Id.* at 186-88.

89. Reed's law is the assertion of David P. Reed that the utility of large networks, particularly social networks, can scale exponentially with the size of the network. The reason for this is that the number of possible sub-groups of network participants is $2^N - N - 1$, where N is the number of participants. This grows much more rapidly than either the number of participants, N, or the number of possible pair connections, $N(N-1)/2$ (which follows Metcalfe's law) so that even if the utility of groups available to be joined is very small on a peer-group basis, eventually the network effect of potential group membership can dominate the overall economics of the system. Reed's Law, WIKIPEDIA (Jan. 13, 2014, 7:25 PM), http://en.wikipedia.org/wiki/Reed%27s_law.

90. David Reed, *That Sneaky Exponential: Beyond Metcalfe's Law to the Power of Community Building* (Jan. 3, 2014, 10:00 PM), http://www.reed.com/dpr/locus/gfn/reedslaw.html; Cooper, *From Wi-Fi to Wikis and Open Source*, *supra* note 61, at 135.

91. *See* Mark Cooper, The Failure Of Market Fundamentalism: What Are The Issues In The ICT Sector? (Mar 20, 2009)

market power to extract rents and undermine competition, rather than interconnect was as strong at the turn of the twenty-first century as it was at the turn of the twentieth, where deregulation in the airline and railroad industries made interline movements the first victims of deregulation; as network operators want to drive end-to-end traffic onto their networks and they develop elaborate strategies for doing so.[92] In each of the cases of deregulation, the post-deregulation industry looked nothing like the pre-deregulation competition theory predicted, yet policy makers are urged to just plow ahead, in spite of the fact that behavior contradicts the theoretical basis for deregulation.[93]

The telecommunications sector is not an exception. The reconstitution of integrated local and long distance companies through mergers by firms that also dominate wireless and have joint-ventures with their closest cable rivals bears no resemblance to the "sweet spot" that the pre-divestiture theory identified as the place where quasi-competition might produce "voluntary" integration between independent networks. Special access services, which allow competitors to interconnect with the wireline telecommunications network, have been a source of constant complaint about abuse since the industry was deregulated.[94]

The FCC has successfully asserted jurisdiction over roaming charges for wireless interconnection.[95] In the realm of interconnection, even though the FCC asserted authority to compel interconnection, the telecommunications carriers have ignored, pushed the limits of, and violated the FCC's rules in a short period of time, suggesting that, absent the public policy principles that require integration, it will not be observed.[96]

In fact, in each of these network infrastructure industries we observe a period of pseudo-access competition (quasi-competition is too strong a word).[97] Small, "mom and pop," service providers crop up in unserved areas to extend service. Head-to-head competition does not make sense to these entrants and is quite rare. Interconnection also is not attractive to them, as they guard their local monopoly as a source of potential rents.[98] In order to get going, the small entrants rely on inferior technology, offer services on non-compensatory rates, and fail to maintain their quality of service. In short order, there is a wave of bankruptcies and buyouts. Advocates of competition, ignoring economies of scale and the rigors of minimum efficient scale, wave their arms in the air and complain about the evils of concentration.

This pattern occurred in the railroads (1860s-1870s), telephone (1910s-1930s), cable industry

---

(unpublished manuscript), *available at* http://www4.gsb.columbia.edu/rt/null?&exclusive=filemgr.download&file_id=70142&rtcontentdisposition=filename%3DCooper.pdf; Mark Cooper, *Recognizing the Limits of Markets, Rediscovering Public Interest in Utilities*, *in* ELECTRIC AND NATURAL GAS BUSINESS: UNDERSTANDING IT! (Robert E. Willett ed., 2003).

92. Mark Cooper, Freeing Public Policy From The Deregulation Debate: The Airline Industry Comes Of Age (And Should Be Held Accountable For Its Anticompetitive Behavior) (Jan. 22, 1999) (unpublished manuscript), *available at* http://www.consumerfed.org/pdfs/abaair1.pdf (airlines have developed the hub and spoke structure, which was not predicted by deregulatory theory); Consumer Federation Of America, Comments of the Consumer Federation Of America On November 2008 Report Of L.R. Christensen Associates, Inc. (Comments to U.S. Surface Transportation Board, Ex Parte No. 680, Study Of Competition In The Freight Rail Industry Dec. 22, 2008), *available at* http://docs.stb.dot.gov/?sGet&Dl1YTH1WXw1zAAwFXBRSV0x6Sw1xfAQGXAIGCW4DF3wCe3cGXQsHCmYFFgkFdBJVAl9GcUsOS1FELBJGO1dES0ZcQQ0AfQADS1RfVEpdTl1VcAYEWQAFDQoBakBUK20yNjgvMy8wME00Ngw%3D (railroads have developed “paper barriers” to prevent short lines from interconnecting with multiple long-haul railroads).

93. Cooper, *supra* note 92.

94. FED. COMMC’NS COMM. FCC ISSUES COMPREHENSIVE DATA REQUEST IN SPECIAL ACCESS PROCEEDING (Sept. 19, 2011), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-309670A1.pdf.

95. The interconnection between the wireless and wireline networks has been subject to FCC authority under title III throughout.

96. *See generally* Mark Cooper, Broken Promises and Strangled Competition: The Record of Baby Bell Merger and Market Opening Behavior (June 2005) (unpublished manuscript), *available at* http://www.consumerfed.org/pdfs/telco_broken-promises_exec_sum.pdf.

97. CRAWFORD, *supra* note 67.

98. STONE, *supra* note 3.

(1970s-1990s), and cellular service (2000-2010).[99] Incumbent telecommunications carriers strangled competition where it represented a threat, as in the 'Baby Bell' approach to interconnection with the competitive local exchange carriers after the 1934 Act. To the extent there is end-to-end seamless integration of infrastructure communications networks, that is the result of mandated integration.

Ironically, a claim that an especially weak form of pseudo-access competition (especially weak because it was not head-to-head, intramodal competition but intermodal competition) would discipline market power in broadband access played a key role in leading the FCC to misclassify high-speed data transmission as an information service.[100] Pseudo-competition quickly gave way to a monopoly, or at best a cozy duopoly in access.[101] As shown in Section III, speculation about the possibility of future competition that might develop was a very weak and illegal basis on which to pin the future of the public-service principles of the Communications Act. Congress placed a much higher value on the principles and established a much more rigorous process to relax regulation, a process that the FCC mistakenly ignored.[102]

D. The Inadequacies of Command-and-Control Regulation to Guarantee Public-service principles in the Digital Communications Space

As noted above, the twentieth century approach to promoting the public-service principles of the communications sector relied on command-and-control regulation. Some would like to extend it, lock, stock and barrel to the twenty-first century digital network.[103] Yet, there are good reasons to believe that command-and-control regulation is not well-suited to the new mode of production. Repeating the historic pattern, new enforcement mechanisms are needed.

First, the dynamic, complex, and interconnected nature of the twenty-first century economy, particularly those sectors touched by digital technologies, makes it difficult for centralized, bureaucratic oversight to write and enforce regulation.[104] Ponderously slow-moving common carriage may have been well-suited for railroad tracks, copper wires, electricity grids, and water pipes—products which are relatively homogeneous and static—but it is ill-suited to the dynamic digital environment. Given

---

99. *Id.* at 21 (noting each of the short periods of competitive access gives way to monopoly markets).

100. Rob Frieden, *From Bad to Worse: Assessing the Long-Term Consequences of Four Controversial FCC Decisions*, 77 BROOKLYN L. REV., 959, 963, 974, 999 (2012) (noting the repeated role that intermodal competition plays).

101. Consumer Fed'n of America & Consumer's Union, Lessons From 1996 Telecommunications Act: Deregulation Before Meaningful Competition Spells Consumer Disaster (Feb. 2001) (unpublished manuscript), *available at* http://consumersunion.org/pdf/lesson.pdf; Mark Cooper, The Failure of 'Intermodal Competition in Cable Markets, (Apr. 2002) (unpublished manuscript), *available at* http://www.consumerfed.org/pdfs/intercomp.20020423.pdf.

102. 47 U.S.C. § 160 (2012) (Section 10 forbearance entails a finding about specific regulation).

103. *E.g.,* CRAWFORD, *supra* note 67.

104. *See* OFFICE OF COMMUNICATIONS (UK), IDENTIFYING APPROPRIATE REGULATORY SOLUTIONS: PRINCIPLES FOR ANALYZING SELF- AND CO-REGULATION 4 (2008), *available at* http://stakeholders.ofcom.org.uk/binaries/consultations/coregulation/statement/statement.pdf ("[I]ndustry-led approaches can play an important role in delivering regulatory objectives: these can help address an issue quickly and flexibly while benefiting from industry expertise, often at a lower cost to society than formal regulation. Timeliness and flexibility of solutions are particularly critical in fast moving, technologically complex communications markets."); Neil Gunningham, Reconfiguring Environmental Regulation: The Future Public Policy Agenda 9 (2005) (unpublished manuscript), *available at* http://www.lafollette.wisc.edu/research/environmentalpolicy/gunninghamreconfigure.pdf (quoting Daniel J. Fiorino, *Rethinking Environmental Regulation: Perspectives from Law and Governance*, 23 HARV. ENVTL. L. REV. 441, 464 (1999)) ("A common theme is that traditional regulation is not suited to meet many contemporary policy needs (although as we emphasize below, it still has a role to play), and indeed it is partly in response to the perceived shortcomings of the regulatory *status quo* . . . . 'underlying each strand in the literature is the belief that the increased complexity, dynamism, diversity, and interdependence of contemporary society makes old policy technologies and patterns of governance obsolete.'); Denis D. Hirsch, *The Law and Policy of Online Privacy: Regulation, Self-Regulation, or Co-Regulation?*, 34 SEATTLE U. L. REV. 439, 458 (2011).

that common carriage was the exception in the long history of public-service principles we should be open to alternative ways of ensuring nondiscrimination in the digital economy, even as we reject the *ex post* approach.

The magnitude of the difference between the digital communications space and other infrastructure networks is stunning. Two analogies that are frequently made are the highway system and electricity. The former is a public sector undertaking. The latter is a regulated private utility. In the five decades from 1960 to 2010, the output of these two infrastructure industries increased by more than four-fold.[105] In contrast, the traffic flowing on the Internet has been almost doubling every year since 1996.[106] The increase in the diversity of traffic was also orders of magnitude greater than in the other network infrastructure industries as well.

Second, the legitimacy of the state to exercise authority is weakened in an increasingly complex environment, where the complexity is, in part, the result of the enrichment and growth of the communications capabilities. The command-and-control-model reflected the passive representational pattern of the nineteenth and twentieth century. The command-and-control regulation rests on the assumption of delegation of authority from a passive public to an expert agency through institutions of representative democracy. In light of the dramatic increase in communications and empowerment at the edge, the traditional approach to democratic participation has become stale. The twenty-first century citizenry is vastly more heterogeneous and active. The borderless, transnational nature of the Internet resource system compounds the problem of weakening state authority. Because information flows are so fluid and multinational, it is argued that the challenge to national authority is well beyond the typical international challenge.[107]

The above two factors involve very fundamental economic and political problems with command-and-control regulation. These have been compounded by more superficial but important factors. The traditional approach to formal notice and comment regulation was based on the belief that expert agencies could do a better job than political bodies such as legislatures in designing regulation in dealing with the day-to-day functioning of industries. Once the regulatory agency becomes politicized, it loses its advantage.[108] The model of an expert agency relied upon to implement broad goals has been undermined by the politicization of the regulatory process. Moreover, traditional regulation is not likely

105. Energy Information Administration, Monthly energy Review, Table 7.2a (Feb. 2014), http://www.eia.gov/totalenergy/data/monthly/pdf/sec7_5.pdf (electricity consumption in 2010 was 5.3 times what it was in 1960); Bureau of Transportation Statistics, Table 1-40: U.S. Passenger-Miles (Millions) http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_01_40.html (vehicle miles traveled in 2010 were 3.3 times those traveled in 1960).

106. *Internet Traffic*, WIKIPEDIA (Mar. 16, 2014, 6:24 PM), http://en.wikipedia.org/wiki/Internet_traffic.

107. ELENA PAVAN, FRAMES AND CONNECTIONS IN THE GOVERNANCE OF GLOBAL COMMUNICATIONS: A NETWORK STUDY OF THE INTERNET GOVERNANCE FORUM xxix (2012) (concisely summarizing all of the issues discussed up to this point: "we are standing in an epoch of overall political uncertainty caused, in the first place, by the fact that states have to face multiple and complex issues that extend beyond the boundaries of their sovereignty and, more importantly, that require an incredibly large amount of competency to be managed adequately. This does not mean that states have lost their functions: institutions continue to be the sole agents in charge of producing policies. What changes is that they can no longer perform their functions 'behind closed doors' but, rather, find themselves forced to act within a very crowded environment, populated by a multiplicity of non-institutional actors who possess the required knowledge and the expertise for managing complex and dynamic global issues. How to translate the necessity for multifactor collaboration into efficient governance arrangements remains an open question. This is particularly true in the case of information and communications matters, where technical and social aspects are both relevant and so interwoven that, when it comes to their regulation, governments have to coordinate a plurality of interests, knowledge, agendas, and priorities but often are not equipped with the necessary competencies to do so.") (internal citations omitted).

108. *See* Jo Becker & Barton Gellman, *Leaving No Tracks*, WASH. POST, June 27, 2007, at A01, *available at* http://voices.washingtonpost.com/cheney/chapters/leaving_no_tracks (suggesting that while producers complain about the involvement of public interest groups, it is certainly true that there has been a politicization of the process on both sides and industry has generally gotten the best of it, symbolized by Vice President Dick Cheney's campaign against environmental regulation in which he told his clients to "match the science").

to work very well because the ability of the state to implement and enforce regulation has been undermined by systematic and persistent defunding of regulatory agencies.[109] Decades of anti-government and pro-market rhetoric have taken their toll. The agencies now lack the resources to do their jobs.[110] In the United States, the number of regulatory and antitrust employees per dollar of value they oversee in the economy at large and the communications sector is one-fifth the level it was in 1970.[111] Compared to profits and assets, agency budgets are less than half the level they were in 1970.[112]

None of these factors is likely to be reversed any time soon. Rather than expending a great deal of effort trying to rehabilitate an enforcement mechanism that is not likely to work very well, even if it is resurrected, public policy should embrace new approaches to advancing and enforcing the expanding set of public-service principles.

E. Expansion of Access in the 3rd Industrial Revolution: Creating Space Between the Market and the State

The search for a new model to advance the public-service principles without undermining the dynamic nature of the core communications resource system of the digital economy need go no further than the examples provided by the digital revolution itself. The Internet protocols and Wi-Fi are remarkable communications systems based on brutally simple obligations of interconnection and integration, open to all on a nondiscriminatory basis, supported by voluntary standards, and managed by multi-stakeholder processes that promote interoperability. A key spark is provided by a regulatory decision of guaranteed access, while a backstop of the threat of further governmental oversight ensures that access is available.

In both cases, the government had an important role in creating the environment in which an entirely new approach to communications could thrive.[113] This is a space that lies between the market and the state in the sense that the abuse of power by dominant communications companies and government regulators was held in check.

The Caterfone and the Computer Inquiries launched in the late 1960s ensured that nondiscriminatory access to the telecommunications network would extend to the flow of data and that innovation in customer premise equipment could flourish.[114] The dominant incumbent telecommunications carrier despised the idea of a decentralized communications protocol and would have quickly throttled it by denying access had it been allowed to, just as it had done a century earlier at the start of the telephone age.[115] Without decisive public policy action by the FCC, the telecommunications companies might have defeated decentralized communications altogether; they certainly would have slowed its development down and probably would have distorted its growth, if

---

109. *See* Mark Cooper, Crowd Sourcing Enforcement: Building a Platform for Participatory Regulation in the Digital Information Age (Feb. 12, 2010) (unpublished manuscript), *available at* http://siliconflatirons.com/documents/conferences/2011.02.13/MarkCooperPresentation.pdf.

110. *See* Mark Cooper, *The Future of Journalism: Addressing Pervasive Market Failure with Public Policy*, *in* WILL THE LAST REPORTER TURN OUT THE LIGHTS 320 (Robert W. McChesney & Victor Pickard eds., 2011).

111. Cooper, *supra* note 109.

112. *Id.*

113. Cooper, *supra* note 17.

114. Robert Cannon, *Where Internet Service Providers and Telephone Companies Compete: A Guide to the Computer Inquiries, Enhanced Service Providers and Information Service Providers*, 9 COMMLAW CONSPECTUS 49 (2001).

115. JANET ABBATE, INVENTING THE INTERNET (INSIDE TECHNOLOGY) 7 (2000) (recounting the hostility of AT&T to the idea of a decentralized switching protocol in the formative period of the Internet); JOHNATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: TELECOMMUNICATIONS LAW & POLICY IN THE INTERNET AGE 23 (2013) (recounting the much more public opposition to interconnection of "foreign" equipment, long distance, and the Computer Inquiries, all of which played important parts in building the Internet).

only by forcing the government to regulate the space more intensely. The voluntary action of the developers of the new communications protocol to fill the space opened by government action was a key ingredient for success. The social institutions they developed and used to manage the decentralized network for thirty years deserve close study and deference as candidates for the future governance structure of the communications network.

The Caterfone and the Computer Inquiries must be seen as the origin and foundation for a significant shift in the thrust of public policy with respect to the communications network. They introduce the possibility for innovation at the edge of the network as a primary driver of economic activity.[116] Once any device can connect and transmit information, individuals are free to invent new uses and applications. Functionalities that were monopolized by the network operator or, more importantly, never dreamed of by them, become possible. The critically important change is to ensure that traffic flows first and shift a heavy burden onto the network operator to show that it should not. When the broader digital revolution located an immense amount of intelligence (computational power) at the edge of the network with the personal computer, the possibilities became virtually limitless.

AT&T's desire for centralized control did not go quietly into history. It repeatedly complained that services and communications by innovators should be stopped.[117] By resisting the attempts of AT&T to burden the decentralization of innovation, the FCC established an environment in which innovation at the edge could flourish to become the driving force for economic and productivity growth.[118]

The mid-1980s spread spectrum rulemaking adopted by the FCC to allow everyone and anyone to have access to radio frequencies long considered garbage by the commercial users of the public airwaves, subject to simple rules of use, had a similar effect.[119] It ensured access to an irreplaceable, raw communications resource in the most deregulatory, free market approach imaginable, unlicensed, universal access. The private sector concluded, to its credit, that a common communications protocol would expand the market and the best approach was to create voluntary institutions to adopt and defend those standards.[120] Had they not done so, there is a good chance that the government would have stepped in to ensure interoperability, with rules that would have been significantly less friendly to innovation,

116. TIM WU, THE MASTER SWITCH: THE RISE AND FALL OF INFORMATION EMPIRES 190-91 (2011) ("[t]he phone jack and the Caterfone decision made it possible to sell to the public devices like fax machines and competitively price (non-Bell) telephones. They also made possible the career of Dennis Hayes, a computer hobbyist ('geek' is the term of art) who, in 1977 built the first modulator/demodulator (modem) designed and priced for consumers . . . . He built, that is, the first consumer device that allowed personal computers to talk to each other, and with that you can spy the first causal relations between the federal deregulation of the 1990s and the birth of the Internet . . . with strange and unprecedented foresight, the FCC watered, fertilized, and cultivated online computer services as a special protected industry, and, over the years, ordained a set of rules called the *Computer Inquiries*, a complex regime designed both to prevent AT&T from destroying any budding firm and also to ensure that online computer services flourished unregulated. What matters so much for the fate of telecommunications and our narrative is that he infant In short, in these obscure and largely forgotten regimes, the new FCC played surrogate parent to the Internet firms.").

117. *Id.* The opposition drove the FCC to continually modify the rules written in the Computer Inquiries.

118. Stephen S. Cohen, et al., *Tools: The Drivers of E-commerce in* TRACKING A TRANSFORMATION: E-COMMERCE AND THE TERMS OF COMPETITION IN INDUSTRIES 3 (Stephen S. Cohen, et al. eds., 2001); François Bar, *The Construction of Marketplace Architecture, in* TRACKING A TRANSFORMATION: E-COMMERCE AND THE TERMS OF COMPETITION IN INDUSTRIES 27 (Stephen S. Cohen, et al. eds., 2001).

119. Mark Cooper, Governing the Spectrum Commons: A Framework for Rules Based on Principles of Common-Pool Resource Management (Mar. 2, 2006) (unpublished manuscript), *available at* http://cyberlaw.stanford.edu/attachments/GOVERNING%20THE%20SPECTRUM%20COMMONS.pdf; Mark Cooper, Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves: the Dramatic Success of Combining Market Principles and Shared Access (Jan. 2012) (unpublished manuscript), *available at* http://www.markcooperresearch.com/SharedSpectrumAnalysis.pdf; Comments Of The Consumer Fed'n Of Am., to *Notice of Proposed Rulemaking* in Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auction, 27 FCC Rcd. 12,357 (Jan. 25, 2013), *available at* http://apps.fcc.gov/ecfs/document/view?id=7022112311.

120. Cooper, Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves, *supra* note 119**;** Kai Jakobs, et al., *Creating a Wireless LAN Standard: IEEE 802.11, in* THE INNOVATION JOURNEY OF WI-FI: THE ROAD TO GLOBAL SUCCESS 53 (Wolter Lemstra, et al. eds. 2011).

entrepreneurship, and consumers.

In both cases, the rules were structured in such a way that the government did not have to get involved in the day-to-day regulation of behavior. In both cases, because of the deregulatory age in which these decisions were made, the presumption was shifted in favor of the freedom to act. The incumbent network operators had to show that devices would harm the network, or data traffic should not be allowed to flow, which they rarely, if ever were able to show.

For three decades encompassing the birth, childhood and adolescence of the digital communications revolution, Internet traffic flowed freely over the telecommunications network (free as in speech, not as in beer) under the Computer Inquiries to devices that were made possible by the Carter phone decision. Shifting to an approach that offered *ex ante* freedom and required the powerful incumbent to prove *ex post* harm to the network, rather than requiring the entrants to show *ex ante* they would do no harm (by offering a simple certification standard and process) is a key pillar on which future interconnection policy should stand.

The model worked precisely because it was located between the market and the state. The state used its power to create a space that was free from the worst instincts of both the market and the state, and the private actors who wanted to enter that space realized that they needed to regulate themselves in a manner consistent with the principle of nondiscrimination, which they equated with interoperability.

Unlike the Internet and the Wi-Fi communities, which engaged in vigorous and effective voluntary self-organizing efforts to develop protocols and processes to keep their respective spaces open,[121] the telecommunications infrastructure network operators had the opportunity after the Cable Modem Order with the declaration of the four Internet freedoms, and again after the Wireline Broadband Order, and the Network Neutrality Order to follow the model of the IP-community and the Wi-Fi-community.[122] They could have filled the space opened by the Cable Modem and Wireline Broadband Orders with a vigorous voluntary process to demonstrate a commitment to the four freedoms. They failed utterly to do so, immediately attacking and infringing the principles.[123] History repeats itself; incumbent network operators have never willingly conceded constraints on their market power in half a millennium. Forced to operate networks in an open access manner, they make the most of it, but they do not create such networks. Open spaces like the Internet and Wi-Fi protocols are the meat and potatoes of new entrants and entrepreneurs but anathema to entrenched network incumbents.

The flexible, multi-stakeholder approach to implementing public-service principles that are well-defined in statutes is a challenging process but one that has proven successful and holds much greater potential for success than the alternatives. This approach has been embraced broadly by the Internet community and important policymakers. Exhibit II-5—drawn from an OECD policy Communiqué that U.S. authorities helped to develop and have embraced—reflects the importance of the public-service principles, the vital role that the state plays in implementing the principles, and also the desire to have voluntary, multi-stakeholder processes accomplish as much of the goals as possible. The key observation here is that striving to use flexible, civil society processes as much as possible does not require one to disavow the importance of the role of the state in defining and defending the public-service principles.

121. *See* Robert E. Kahn & Vinton G. Cerf, *What is the Internet (and what makes it work)?, in* OPEN ARCHITECTURE AS COMMUNICATIONS POLICY: PRESERVING INTERNET FREEDOM IN THE BROADBAND ERA 17 (Mark N. Cooper ed., 2004).

122. *See* Cooper, Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves, *supra* note 119; Jakobs, *supra* note 120.

123. The best indication of this behavior is the constant litigation of FCC efforts to implement the orders. Comcast Corp. v. Fed. Commc'ns Comm'n, 600 F.3d 642 (D.C. Cir. 2010); Verizon v. Fed. Commc'ns Comm'n, 740 F.3d 623 (D.C. Cir. 2014).

Exhibit II-5: Public-service principles in the Global Context: OECD Communiqué on Principles for Internet Policy-Making[124]

We recognised the essential contribution of stakeholders, including business, civil society, the Internet technical community and academic institutions, to the ongoing development of the Internet and the enrichment of society using the Internet….

We emphasised that, in certain cases, public support and investment may be needed to ensure the greatest practical availability of these networks in our countries, in particular in rural and remote areas, and that such public intervention should support market competition and promote private investment initiatives…

The roles, openness, and competencies of the global multi-stakeholder institutions that govern standards for different layers of Internet components should be recognised and their contribution should be sought on the different technical elements of public policy objectives. Maintaining technology neutrality and appropriate quality for all Internet services is also important to ensure an open and dynamic Internet environment. Provision of open Internet access services is critical for the Internet economy…

Suppliers should have the ability to supply services over the Internet on a cross-border and technologically neutral basis in a manner that promotes interoperability of services and technologies, where appropriate. Users should have the ability to access and generate lawful content and run applications of their choice. To ensure cost effectiveness and other efficiencies, other barriers to the location, access and use of cross-border data facilities and functions should be minimised, providing that appropriate data protection and security measures are implemented in a manner consistent with the relevant OECD Guidelines…

Governments may be able to achieve certain policy goals through flexible, adaptive means by encouraging, facilitating and supporting the development of codes of conduct that are supported by effective accountability mechanisms… Such co-operative efforts should be balanced and consistent with the applicable legal framework and where those co-operative efforts are not forthcoming, other policy options consistent with these principles should be considered in consultation with relevant stakeholders…

Strong privacy protection is critical to ensuring that the Internet fulfills its social and economic potential. Current privacy challenges are likely to become more acute as the economy and society depends more heavily on broadened and innovative uses of personal information that can be more easily gathered, stored, and analysed… Privacy rules should be based on globally recognised principles, such as the OECD privacy guidelines, and governments should work to achieve global interoperability by extending mutual recognition of laws that achieve the same objectives. Cross-border enforcement co-operation will further protect privacy and promote innovation. Privacy rules should also consider the fundamental rights of others in society including rights to freedom of speech, freedom of the press, and an open and transparent government.

Low barriers to entry enabled by the open platform nature of the Internet environment have been crucial to online creativity and innovation. Policies and practices should continue to encourage and promote an Internet environment which is conducive to launching creative and innovative technologies, businesses, and other endeavours that respect recognised legal rights without having to obtain permission or affirmative co-operation from established service providers.

Encouraging investment and innovation in the Internet marketplace requires clearly defined legal rights and a robust and fair process to protect those rights, including users' rights, consistent with the need of governments to enforce applicable law. It is important in this regard that governments, industry and civil society work together to foster respect for the law and protect fundamental rights. Sufficient government enforcement resources and industry co-operation should also be available to ensure that Internet-based activities comply with law. Current legislative and regulatory provisions could be reviewed to ensure that they can be effectively enforced and are consistent with fundamental rights.

III. The Legal Foundation for Public-Service Principles to Govern the Digital Communications Network

This section shows that the FCC has the tools to maintain and advance the public-service principles of the communications network as it transitions from twentieth century time-division multiplexing switching facilities to twenty-first century Internet protocol ("IP") switching facilities. Its ability to maintain and advance these principles has been made more difficult by an initial decision that appears to have placed its authority to implement the Communications Act for advanced telecommunications services in doubt, but that is a reversible error.[125]

124. The Organisation for Econ. Co-operation & Dev., Communiqué on Principles for Internet Policy-Making (2011), *available at* http://www.oecd.org/internet/innovation/48289796.pdf.

125. Mark Cooper, Handicapping the Next Network Neutrality Court Case, Address before National Association of Regulatory Utility Commissioners (July 19, 2010).

The FCC ended up in the wrong place because it took the wrong approach to a narrow consideration of only one of the public service obligations of telecommunications carriers. Consideration of the full range of issues and the full body of evidence demonstrates that there is strong legal, historical, policy, technological, and economic evidence to support the classification of high-speed data transmission as a telecommunications service. Thus, when considering the full range of policy issues raised by the petitions to sunset the PSTN, classifying high-speed data transmission would not be a matter of "reclassifying" high-speed data transmission as a telecommunications service; it is more a correction of its partial misclassification as an information service.

A. Advanced Telecommunications Services are Telecommunications Services that are Governed by the Public-service principles of the Act

As noted above, the goals of the 1934 Act, referred to as the public-service principles or public interest obligations of telecommunications carriers include integration (nondiscriminatory interconnection and carriage), universal service, public safety, access for people with disabilities, consumer protection, and protection of consumer privacy.[126] The goals are stated in the first sentence of the Communications Act, and the statute links those goals directly to the tools for achieving them, which are laid out in Titles II and III. In these subsequent Titles, Congress not only defined the public interest goals with precision, it also identified the specific tools and procedures that the Commission should use to accomplish them. The Telecommunications Act of 1996 reaffirmed the commitment to these goals and strengthened them in several ways.

AT&T's petition to sunset the PSTN reveals the fundamental flaw in the approach taken by the FCC to the definition of services since the passage of the Telecommunications Act of 1996. In updating the 1934 Act, Congress embraced the framing of the definition of services and the approach to regulation that had been developed by the FCC and the courts over the previous quarter of a century. Congress explicitly intended for the public-service principles to apply to the evolving telecommunications environment by defining telecommunications services, "regardless of the facilities used" to deliver service to the public.[127]

In affirming and expanding the commitment to universal service, Congress stated that "the Joint Board and the Commission shall base policies for the preservation and advancement of universals service on the following principles."[128] Among these was access to advanced telecommunications and information services.[129] The definitions clause of the Universal Service section declares that "[u]niversal service is an evolving level of telecommunications services that the Commission shall establish periodically under this section, taking into account advances in telecommunications and information technologies and services."[130] The next section, entitled "Access by persons with disabilities," was tied to this definition of telecommunications services.

The close fit between the language of the statue and the underlying technology led the court in the initial test of the definition of telecommunications service applied to cable modem service to conclude

---

126. *See supra* EXHIBITS I-1, I-2, I-3.

127. Brief of Petitioner at 17, Brand X Internet Servs. v. Fed. Commc'ns Comm'n, 345 F.3d 1120 (9th Cir. 2003) (Nos. 02-70518, 02-70684, 02-70685, 02-70686, 02-70879, 02-71425 and 02-72251), 2002 WL 32191908, at *14 (quoted in Earl W. Comstock & John W. Butler, *Access Denied: The FCC's Failure to Implement Open Access to Cable as Required by the Communications Act* in OPEN ARCHITECTURE AS COMMUNICATIONS POLICY: PRESERVING INTERNET FREEDOM IN THE BROADBAND ERA 283, 304 (Mark N. Cooper ed., 2004)).

128. 47 U.S.C. § 254(b) (2012).

129. *Id.* at (b)(2).

130. *Id.* at (c)(1).

that, as a matter of law and policy, high-speed data transmission is clearly a telecommunications service, stating:

> Among its broad reforms, the Telecommunications Act of 1996 enacted a competitive principle embodied by the dual duties of nondiscrimination and interconnection. See 47 U.S.C. § 201 (a) . . . § 251 (1) . . . . Together, these provisions mandate a network architecture that prioritizes consumer choice, demonstrated by vigorous competition among telecommunications carriers. As applied to the Internet, Portland calls it "open access," while AT&T dysphemizes it as "forced access." Under the Communications Act, this principle of telecommunication common carriage governs cable broadband as it does other means of Internet transmission such as telephone service and DSL, "regardless of the facilities used." 47 U.S.C. § 153(46). The Internet's protocols themselves manifest a related principle called "end-to-end": control lies at the ends of the network where the users are, leaving a simple network that is neutral with respect to the data it transmits, like any common carrier. On this the role of the Internet, the codes of the legislator and the programmer agree.[131]

B. Providing for Forbearance from Regulation

The Telecommunications Act allowed the Commission to forebear from applying specific rules in specific circumstances, if it found that those rules were no longer necessary in the public interest to accomplish the goals of the Act.[132] It never contemplated that the Commission would give up its authority to adopt policies to achieve the goals. Yet that is exactly what has happened because the Commission mishandled the distinction between information services and the telecommunications facilities that communications carriers use to deliver those services to the public for a fee.[133]

In outlining the conditions under which the FCC could forbear from regulation, Congress was precise and identified the public-service principles as touchstones. The statute requires the Commission to ensure that key public-service principles will be protected. It invokes the key nondiscrimination and consumer protection language from section 201, as well as a broader concern about consumer protection, as the following language from the statue makes clear:

> (a) REGULATORY FLEXIBILITY- Notwithstanding section 332(c)(1)(A) of this Act, the Commission shall forbear from applying any regulation or any provision of this Act to a telecommunications carrier or telecommunications service, or class of telecommunications carriers or telecommunications services, in any or some of its or their geographic markets, if the Commission determines that—
>
> (1) enforcement of such regulation or provision is not necessary to ensure that the charges, practices, classifications, or regulations by, for, or in connection with that telecommunications carrier or telecommunications service are just and reasonable and are not unjustly or unreasonably discriminatory;
>
> (2) enforcement of such regulation or provision is not necessary for the protection of consumers; and
>
> (3) forbearance from applying such provision or regulation is consistent with the public interest.
>
> (b) COMPETITIVE EFFECT TO BE WEIGHED- In making the determination under subsection (a)(3), the Commission shall consider whether forbearance from enforcing the provision or regulation will promote competitive market conditions, including the extent to which such forbearance will enhance competition among providers of telecommunications services. If the Commission determines

131. Am. Telephone &Telegraph Corp. v. Portland, 216 F.3d 871, 879 (9th Cir. 2000).
132. 47 U.S.C. § 205 (2012).
133. *Id.*

> that such forbearance will promote competition among providers of telecommunications services, that determination may be the basis for a Commission finding that forbearance is in the public interest.
>
> . . .
>
> (d) LIMITATION- Except as provided in section 251(f), the Commission may not forbear from applying the requirements of section 251(c) or 271 under subsection (a) of this section.[134]

This framing very carefully and explicitly separates the public-service principles from the competitive aspirations of the Act. Subsection (b) allows the promotion of competition to meet subsection (a)(3), but subsections (a)(1) and (a)(2) must also be met. Moreover, there are some provisions that are not subject to forbearance.

134. *Id*. at § 160.

WHY GROWING UP IS HARD TO DO: INSTITUTIONAL CHALLENGES FOR INTERNET GOVERNANCE IN THE "QUARTER-LIFE CRISIS" OF THE DIGITAL REVOLUTION

MARK COOPER*

I. INTRODUCTION

A. The Quarter-life Crises of Industrial Revolutions

The popular press tends to mark the birthdays and anniversaries of innovations and products by the date at which they became widely available to the general public. While this standard is never precise and there is a flow of inventions before commercialization, it is a useful benchmark for measuring social change. By that standard there is no doubt that the early years of the 21st century are a key period for the digital revolution and its most important manifestation, the Internet. The adolescence of the Internet is ending, which is typically marked by the shouldering of new, adult responsibilities. In humans it has come to be called the quarter-life crisis.

The **quarter-life crisis** is a period of life following the major changes of adolescence, usually ranging from the late teens to the early thirties, in which a person begins to feel doubtful about their own lives [sic], brought on by the stress of becoming an adult. The term was coined by analogy with mid-life crisis.[1]

The web celebrated its 20th birthday in 2011[2] and the PC its 30th.[3] The age of the Internet is also in the range of 20-30 years.[4] The Internet Society,[5] which houses the key bodies that set policy for the Internet, turned 20 in 2012. Search engines, which provide a critical function for navigating the vastness of cyberspace, are about 15 years old.[6] Broadband Internet service is in the same age range.[7] Using the dating technique of initial widespread commercial availability to calculate the age of wireless technologies that are playing an increasingly important role in the digital revolution we reach the same conclusion. In 2012, U.S. cellular service is about 30 years old[8] and Wi-Fi is about 20.[9]

To be a true quarter-life crisis, the life expectancy of the digital revolution would have to be about a

* *Journal on Telecommunications and High Technology Law*, 11:1 (2013).

1. *Quarter-life crisis*, WIKIPEDIA, http://en.wikipedia.org/wiki/Quarter-life_crisis (last modified Aug. 19, 2012, 10:16 PM). Given that this paper is about an advance in the generation and distribution of knowledge that may prove to be among the great economic revolutions in human history, this paper relies, to the greatest extent possible, on sources that are readily available on the Web (i.e. not behind pay walls). Since the primary purposes of citations are to allow the reader to check facts, evaluate interpretations, and add to the body of knowledge by reinterpretation and extension (remixing), the ability to make sources instantaneously available is a symbolic marker of how much has been accomplished by the digital revolution. The fact that Wikipedia, a new form of collaborative knowledge enterprise, is the most frequent single source for this paper reinforces this message, as does the fact that Wikipedia provides many live links to available resources.

2. Julia Felsenthal, Heather Murphy & Chris Wilson, *Happy 20th Birthday, World Wide Web!*, SLATE (Aug. 5, 2011, 5:54 PM), http://www.slate.com/slideshows/business _and_tech/happy-20th-birthday-world-wide-web.html; *World Wide Web*, WIKIPEDIA, http://en.wikipedia.org/wiki/World_Wide_Web (last modified Sept. 30, 2012, 7:51 AM).

3. Chloe Albanesius, *On Eve of PC's 30th Birthday, IBM and Microsoft Debate Its Future*, PC MAG.COM (Aug. 11, 2011, 11:06 AM), http://www.pcmag.com/ article2/0,2817,2390897,00.asp; *Personal computer*, WIKIPEDIA, http://en.wikipedia.org/wiki/ Personal_computer (last modified Sept. 28, 2012, 6:04 PM).

4. The Internet protocol is over 40 years old. The first actual network of networks is 25 years old, and the first commercial network to join the network of networks did so 23 years ago, all of which makes the point that the adolescence of the Internet is over. *Internet*, WIKIPEDIA, http://en.wikipedia.org/wiki/Internet (last modified Sept. 25, 2012, 4:06 PM).

5. *Internet Society*, WIKIPEDIA, http://en.wikipedia.org/wiki/Internet_Society (last modified Oct. 1, 2012, 3:14 AM).

6. *History of Google*, WIKIPEDIA, http://en.wikipedia.org/wiki/History_of_Google (last modified Sept. 30, 2012, 12:43 PM).

7. *Broadband*, WIKIPEDIA, http://en.wikipedia.org/wiki/Broadband (last modified Sept. 29, 2012, 10:11 PM); *DOCSIS*, WIKIPEDIA, http://en.wikipedia.org/wiki/DOCSIS, (last modified Sept. 25, 2012, 11:06 PM).

8. *Mobile phone*, WIKIPEDIA, http://en.wikipedia.org/wiki/Mobile_phone (last modified Sept. 30, 2012, 5:14 PM).

9. *Wi-Fi*, WIKIPEDIA, http://en.wikipedia.org/wiki/Wi-Fi (last modified Sept. 29, 2012, 2:53 PM).

century,[10] as proved to be the case for the first two industrial revolutions (see Figure 1-1), but the math is less important than the fact that the digital revolution is confronted with a broad range of maturation challenges in terms of new issues and concerns that are pressing on its future.

As the discussion below shows, the maturation challenges confronting the Internet cover a host of issues, including concerns about

- the central technologies that underlie the revolution (e.g., Internet governance, communications network management, cyber security),
- the economy (e.g., antitrust, consumer protection, intellectual property),
- social issues (e.g., universal service, privacy, personal security), and
- the polity (e.g., free speech, surveillance).

As suggested in Figure I-1, it can be argued that the 1st and 2nd industrial revolutions also went through similar quarter-life crises as new social institutions were developed to ensure that the emerging mode of economic production serves the broader goals of society. However, it also can be argued the quarter-life crisis of the digital revolution promises to be particularly challenging because the digital revolution involves a uniquely powerful and dynamic set of changes.[11] These changes include:

- the unique, decentralized nature of the Internet as a communications medium;
- the speed with which changes are taking place;
- the central role that communications play in modern economies;
- the scale and scope of change that is having a pervasive impact on many aspects of daily life; and
- the fundamental importance of many of the values affected.

Confronted with a challenge of this magnitude, and having a set of fully developed institutions in hand, there is a tendency to assume, or hope that "old law maps to new interactions."[12] The old law we have today was defined by the maturation challenges of the 2nd industrial revolution, which makes many of the institutions over a hundred years old.[13] Because they are old does not necessarily mean they are outdated, and it certainly does not mean the values they express and seek to implement are no longer valid; it does mean they will be challenged to change.[14] Here, too, it can be argued that the quarter-life crisis of the digital revolution is likely to pose major challenges to the existing social institutions that can be expected to be called on as the vehicles for addressing the challenges (asserting authority) for a number of reasons:

10. The quarter life calculation assumes a life span of a century, which is a reasonable historical period in which a technological revolution will be paramount before it is replaced by another. Thus, the "start" of the first industrial revolution is dated from the mid- to late 1700s, the second industrial revolution dates from the mid- to late 1800s, and the Internet from the mid- to late 1900s. *Industrial Revolution*, WIKIPEDIA, http://en.wikipedia.org /wiki/Industrial_Revolution (last modified Sept. 28, 2012, 4:30 PM).

11. Comparing general purpose technologies can be misleading, especially when one is only just reaching maturity, but the evidence on information technologies supports the conclusion that the technologies are spreading quickly and evolving rapidly in terms of price declines, which have traditionally been a major measure of impact. The technologies on which the Internet is based are probably moving faster than the overall IT sector. Boyan Jovanovic & Peter L. Rousseau, *General Purpose Technologies*, *in* HANDBOOK OF ECONOMIC GROWTH 1181, 1182 (Philippe Aghion & Steven N. Durlauf eds., 2005).

12. This observation was offered in an article reporting a (rare) criminal case involving personal security on the Internet. Somini Sengupta, *Case of 8,000 Menacing Posts Tests Limits of Twitter Speech*, N.Y. TIMES, Aug. 27, 2011, at A1 (internal quotation marks omitted), *available at* http://www.nytimes.com/2011/08/27/technology/man-accused-of-stalking-via-twitter-claims-free-speech.html.

13. Much of the structure was put in place during the Progressive Era, which is generally dated from the 1890s, *Progressive Era*, WIKIPEDIA, http://en.wikipedia.org/wiki/Progressive_Era, (last modified Sept. 29, 2012, 9:39 PM), although the New Deal updated and extended the institutional structure. *New Deal*, WIKIPEDIA, http://en.wikipedia.org/wiki/New_Deal, (last modified Sept. 30, 2012, 10:41 PM).

14. Each of the industrial revolutions "stand[s] on the shoulders of giants," i.e. the previous industrial revolution. *Standing on the shoulders of giants*, WIKIPEDIA, http://en.wikipedia.org/wiki/Standing_on_the_shoulders_of_giants (last modified Sept. 27, 2012, 11:34 PM). But each needs a new set of institutions to support the larger structure. Economist Douglass North uses the construction metaphor "scaffolding" to describe the institution building process. DOUGLASS NORTH, UNDERSTANDING THE PROCESS OF ECONOMIC CHANGE ix, 52 (2005). It is interesting to note that the expression dates from the 12th century, early in what North refers to as the second economic revolution – a revolution based on knowledge. *Id.* at 87.

- a lack of clear lines of authority stemming from the transnational nature of the communications;
- concern that institutions that move slowly and rely on rigid rules will have difficulty addressing the challenges without undermining the economic engine at the core of the new communications system that thrives on diversity and dynamic innovation; and
- a decline in the general legitimacy and capacity of the incumbent political institutions.

Invention	Date	Socio-Political Turmoil	Primary Means Mass Communications
1st Industrial Revolution			
Flying Shuttle	1733		
Cotton Mills	1742		
Water Frame	1764		
Spinning Jenny	1765		
Steam Engine	1769		
Steam Ship	1775	Age of	
Threshing Machine	1784	Revolution	
Power Loom	1785	1775	
Cotton Gin,	1793		
Interchangeable Musket Parts	1798		
Steam Locomotive	1804	Luddism	
Steamboat Service on the Hudson River	1807		
Typewriter	1829		
Telegraph, revolver	1836		Penny Press
Sewing Machine	1844,1851	1848	Telegraph
	1860s		Photography
2nd Industrial Revolution			
Bessemer Steel	1855		
Synthetic Dye	1856		
Machine Gun	1862		
Transatlantic Cable, dynamite	1866		
Modern Typewriter	1867		
Tungsten Steel	1868		
Barbed Wire	1873		
Telephone	1876		
Phonograph,	1877		Telephone
Incandescent Light bulb	1879		
Induction Electric Motor	1888	Progressive	
Diesel Engine	1892	Era, 1987	
Radio	1901		
Airplane	1903		
Model T Ford, Assembly Line	1908, 1913		Radio
	1930s	New Deal	
	1940s		Television
3rd Industrial Revolution			
Transistor	1947		
Integrated Circuit	1958		
Micro Computer	1968	Carterphone/	
Internet	1969	Computer Inquiries	
Microprocessor, E-mail	1971		
Modem	1997		
PC-IBM	1980		
Commercial Internet	1986		
Commercial Wireless Service	1984		
WorldWideWeb	1991		
ISOC	1992	CALEA, DMCA,	
	1996	Telecom Act	Broadband
	1998	ICANN	
	1999	COPA,	
	2000		YouTube
	2003	WSIS	
	2004		Social media
	2012	SOPA, PIPA	

FIGURE I-1: LIFE CYCLE OF INDUSTRIAL REVOLUTIONS[15]

B. Purpose and Outline

This paper presents a comprehensive framework for analyzing the quarter-life crisis of the digital revolution with a focus on the Internet as an important (perhaps the most important) resource system at the heart of the digital economy. The way the Internet supports the flow of communications plays a key role in the remarkable success of the digital revolution. The institutions that manage the development and operation of the Internet as a resource system are unique in many respects and have come under pressure as the digital revolution and the Internet mature. The ultimate objective of the paper is to gain insight into how the governance institutions can **adapt** to the demands of the quarter-life crisis.

I choose the word **adapt** purposely, rather than reform, because reform is frequently associated with some sort of failure – "**Reform** means the improvement or amendment of what is wrong, corrupt,

15. Various Wikipedia entries; Bradford R. Smith, *The Third Industrial Revolution: Policymaking for the Internet*, 3 COLUM. SCI. & TECH. L. REV. 1 (2001).

unsatisfactory."[16] The characterization grounded in failure does not apply as a general proposition to the Internet and the digital revolution. This is a case where the need for change derives from remarkable success, not failure, because the dramatic growth of the resource system strains its own governance institutions and because the resource system has expanded so rapidly and penetrated so deeply into so many aspects of social life that it is having a huge impact on society. The fact that the driving force for change is a broad pattern of success, rather than failure, does not make it less urgent, but it does create a somewhat different orientation than reform driven by failure – the challenge of preserving and extending what is working well is prominent, if not paramount.

The analysis covers three levels—resource system (Sections II and III), socio-ecological setting (Section IV and V), and governance institutions (Section VI and VII). The Internet governance debate has come to include all three of these levels, with social policy issues taking center stage. The extent to which the social policy issues can be separated from the resource system issues is hotly debated. This paper argues that doing so is important because preserving the technical basis of success is so important.

Section II presents an analytic framework I call new institutional analysis to explain the success of the Internet as a "focal core resource system" in the 21st century economy. It develops the framework by combining concepts from the Institutional Analysis and Development (IAD) framework of Elinor Ostrom[17] with New Institutional Economics (NIE) offered by Douglass North.[18] By identifying the aspects of the resource system that combined to create its success, the institutional analysis is a useful tool for understanding how the unintended consequences of success create internal pressures for change, in addition to outlining the ways in which the socio-ecological setting places demands on the resource system. Several leading Internet analysts approach the Internet governance debate from the point of view of network theory.[19] I argue that the network framework is virtually identical to the new institutional analysis of a resource system. I prefer the latter because of the very rich set of analytic concepts and proposition that have been built up from a long and large body of empirical analysis.

Section III discusses the speed and scope of growth of performance of the Internet in the context of the digital revolution. The penetration of communications technologies and the increase in usage are the primary measures. It identifies several key pressure points for change within the resource system.

Section IV presents an analytic framework for assessing the demands that the socio-ecological setting places on the Internet resource system. It argues that there are four realms of social structure—technology, economy, socio-cultural, and the polity—that are fundamentally different in nature, giving rise to different maturation challenges. It examines examples of the maturation challenges from two perspectives to provide detail and context for the discussion of Internet governance. First, it identifies the issues that fill the international debate over Internet governance.[20] Second, it offers a U.S. perspective through the debate over the "end of the public switched telephone network," in part because the telecommunications network was and still is an essential, complementary resources system with a close relationship to the Internet.[21]

---

16. *Reform*, WIKIPEDIA, http://en.wikipedia.org/wiki/Reform (last modified Sept. 19, 2012, 9:24 PM).

17. Ostrom's body of work is huge; her Nobel Laureate lecture provides a summary. Elinor Ostrom, Prize Lecture: Beyond Markets and States: Polycentric Governance of Complex Economic Systems (Dec. 8, 2009), *available at* http://www.nobelprize.org/nobel_prizes/economics/laureates/2009/ostrom_lecture.pdf.

18. North's body of work is huge; his Nobel Laureate lecture provides a summary, although he has continued to add to this body for well over a decade. Douglass North, Prize Lecture: Economic Performance through Time (Dec. 9, 1993), *available at* http://www.nobelprize.org/nobel_prizes/economics/laureates/1993/north-lecture.html.

19. *See, e.g.*, MILTON L. MUELLER, NETWORKS AND STATES: THE GLOBAL POLITICS OF INTERNET GOVERNANCE (2010); ELENA PAVAN, FRAMES AND CONNECTIONS IN THE GOVERNANCE OF GLOBAL COMMUNICATIONS: A NETWORK STUDY OF THE INTERNET GOVERNANCE FORUM (2012).

20. *See, e.g.*, Communiqué on Principles for Internet Policy-Making, Org. for Econ. Cooperation & Dev. [OECD], High Level Meeting: The Internet Economy: Generating Innovation and Growth (June 28-29, 2011), http://www.oecd.org/internet/innovation/48289796.pdf; Report of the Working Group on Internet Governance, Internet Governance Forum [IGF], Meeting of the Working Group on Internet Governance (June 2005), http://www.wgig.org/docs/WGIGREPORT.pdf; Code of Ethics for the Information Society Proposed by the Intergovernmental Council of the Information for All Programme (IFAP), UNESCO, General Conference: 36th Session (Oct. 10, 2011), http://unesdoc.unesco.org/images/0021/002126/212696e.pdf.

21. Mark Cooper, Statement at FCC Workshop: The Public Switched Telephone Network in Transition (December 14, 2011),

Section V identifies the key dilemmas that confront the resources system in responding to the demands for change from the socio-ecological setting of the system.

Section II-V provide considerable support for the proposition that the maturation challenges are numerous and substantial and that adaptation of existing institutions is the preferable approach to balancing the goal of preserving the dynamic Internet resource system while ensuring it effectively shoulders its adult responsibilities. Section VI and VII examine possible responses to the challenges.

Section VI presents high-level principles to guide the adaptation of Internet governance. It discusses the support for multi-stakeholder approaches as the widely supported institution for responding to the maturation challenges. It then presents a review of the literature of regulatory reform, which highlights the failure of the discussion of regulatory reform to give adequate attention to participation in the governance process.

Section VII makes the case for "participatory governance" as an institutional response to the need for a 21st century governance institution to guide the digital revolution. It argues that "participatory governance," is an approach that recognizes the declining ability and value of governmental agency oversight over the complex, dynamic and global activities of the digital economy, while asserting that civil society and economic actors can be mobilized to fill the gap that is developing between the need for oversight and the inability of the state to provide it. Extending the finding that the Internet thrived because it was located between the market and the state, Section G argues that the very factors that are making it difficult for the state to oversee economic activity in the digital economy—dynamic technological change on a global scale—also make it possible to increase direct public involvement in the process of overseeing these sectors because of the dramatically increased ability of the public to communicate and organize for collective action.

II. THE SUCCESS OF THE INTERNET AS A FOCAL CORE RESOURCE SYSTEM IN THE DIGITAL ECONOMY

A. The Success of the Internet Resource System

1. New Institutional Analysis

In this section, I describe the success of the Internet as a resource system in the context of an overall analytic framework that can be described as new institutional analysis. I argue that North and Ostrom analyze the creation, evolution, and adaptation of social institutions and social processes with similar concepts from opposite points of view.[22] North analyzes the issue from the macro level of political, economic, and social institutions focusing on the economic performance of societies across long periods of time.[23] Ostrom analyzes the issue from the micro-level performance of specific resource systems, which are embedded in social, economic, and political settings.[24] Combining the two we have not only a complete

---

available at http://www.fcc.gov/events/public-switched-telephone-network-transition-0 (beginning at 79:20); *see also Public switched telephone network*, WIKIPEDIA, http://en.wikipedia.org/wiki/Public_switched_telephone_network (last modified Sept. 28, 2012, 5:46 AM).

22. The compatibility between these two schools of thought is underscored by the fact that the first person Ostrom cites in her Nobel Prize lecture is Douglass North. *See* Ostrom, *supra* note 17, at 408.

23. North, *supra* note 18, ¶¶ 3-4 ("This essay is about institutions and time. It . . . provides the initial scaffolding of an analytical framework capable of increasing our understanding of the historical evolution of economies and a necessarily crude guide to policy in the ongoing task of improving the economic performance of economies . . . . Institutions form the incentive structure of a society and the political and economic institutions, in consequence, are the underlying determinant of economic performance. Time as it relates to economic and societal change is the dimension in which the learning process of human beings shapes the way institutions evolve . . . . ").

24. Ostrom, *supra* note 17, at 432 (referring to the level at which most IAD analysis has been conducted as the "[m]icrosituational level of analysis.") The elements that constitute the analytic framework are microlevel detail. "To specify the structure of a game and predict outcomes, the theorist needs to posit the: 1. characteristics of the actors involved (including the models of human choice adopted by the theorist); 2. positions they hold (e.g. first mover or row player); 3. set of actions that actors can take at specific nodes in a decision tree; 4. amount of information available at a decision node; 5. outcomes that actors jointly affect; 6. set of functions that map actors and actions at decision nodes into intermediate or final outcomes; and 7. Benefits and costs assigned to the linkage of actions chosen and outcomes obtained." *Id*. at 415. This description of the analytic questions leads to seven types of operational rules.)

conceptual framework but also a rich set of methodological tools for empirical analysis.

My goal is not to present a comprehensive account and reconciliation of the work of Ostrom and North. Rather, it is to extract the elements from these very large bodies of work that shed light on why the Internet has been so successful as an institution and what this teaches us about the direction of change that should be followed as it adapts to its maturation challenges.

To appreciate the value of putting the effort into this conceptual framing, I start with the observation that Elinor Ostrom's Nobel Prize Lecture, entitled "Beyond Markets and States: Polycentric Governance of Complex Economic Systems,"[25] describes the current state of the IAD framework as "developing a more general theory of individual choice that recognizes the central role of trust in coping with social dilemmas."[26] In fact, one of the articles she cites as capturing the recent developments of IAD argues that "it has become clear that the real 'glue' that keeps an institution alive over time are the social mechanisms, i.e. trust, legitimacy, and transparency."[27]

The policy challenges that Ostrom derives from her work on resource systems are the challenges that Internet governance faces.

> Extensive empirical research leads me to argue. . . a core goal of public policy should be to facilitate the development of institutions that bring out the best in humans. We need to ask how diverse polycentric institutions help or hinder the innovativeness, learning, adapting, trustworthiness, levels of cooperation of participants, and the achievement of more effective, equitable, and sustainable outcomes at multiple scales.[28]

This statement of the real-world challenge of building institutions to create cooperation in the face of a social dilemma fits the ongoing debate about Internet governance perfectly. The search for polycentric modes of governance that fall between the market and the state where a community self-organizes to build institutions based on trust, legitimacy, and transparency is the search for the holy grail of Internet governance.

Douglass North's framing of the purpose and focus of New Institutional Economics is very similar in spirit and substance.

> Institutions provide the basic structure by which human beings throughout history have created order and attempted to reduce uncertainty in exchange. Together with the technology employed, they determine transaction and transformation costs and hence the profitability and feasibility of engaging in economic activity. . .
>
> There is a different, and I think, better story. It concerns the endless struggle of human beings to solve the problems of cooperation so that they may reap the advantages not only of technology, but also of all the other facets of human endeavor that constitute civilization.[29]

> Institutions form the incentive structure of a society and the political and economic institutions, in consequence, are the underlying determinant of economic performance. Time as it relates to economic and societal change is the dimension in which the learning process of human beings shapes the way institutions evolve. That is, the beliefs that individuals, groups, and societies hold which determine choices are a consequence of learning through time. . . .[30]

---

25. Ostrom, *supra* note 17, at 408.

26. *Id.* at 409.

27. Michael Cox, Gwen Arnold & Sergio Villamayor Tomás, *A Review of Design Principles for Community-Based Natural Resource Management*, ECOLOGY & SOC'Y, Dec. 2010, Art. 38 at 12 (2010) (*quoting* Ingvild Harkes, Fisheries Co-Management, the Role of Local Institutions and Decentralization in Southeast Asia (May 15, 2006) (unpublished Ph.D. thesis, Leiden University), *available at* https://openaccess.leidenuniv.nl/bitstream/handle/1887/4385/Thesis.pdf) (internal quotation marks omitted).

28. Ostrom, *supra* note 17, at 435-36.

4129. DOUGLASS NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE 118, 133 (1990).

30. North, *supra* note 18, ¶ 4.

2. The Conditions for the Institutional Success of the Internet

The usefulness of the analytic framework goes beyond the fact that the central institutional problem it identifies fits the current Internet governance debate well. The "clear set of findings" that are the basis for the generalizations that IAD offers to explain successful institutionalization of a resource system provides a remarkably precise understanding of why the Internet succeeded as a "focal core resource system." As shown in Table II-1, a good case can be made that the Internet possessed most, if not all, of the empirically identified characteristics that make for successful cooperation to deal with a social/economic dilemma.

RULES, FUNCTIONS & INFLUENCES	DESIGN PRINCIPLES	FAVORABLE CONDITIONS
Structure and Units		
Boundary Rules Position Rules	Clarity of Membership Clarity of Resource Congruence between Membership & Resource	Size of resource system: Very large territories are unlikely to self-organize given the high cost of defining boundaries … monitoring use patterns and gaining ecological knowledge. Very small territories do not generate substantial flows of valuable products. Thus, moderate size is most conducive to self-organization.
Control Appropriation Rules Provision Rules	Fair, orderly, efficient Incentive to contribute Reflect local conditions and be congruent	Predictability of system dynamics: System dynamics need to be sufficiently predictable that users can estimate what would happen if they were to particular rules or no entry territories.
Users and Uses		
Collective Choice	Participation Power to act	When users… have full autonomy at the collective choice level to craft their own rules, they face lower transactions costs as well as lower costs in defending a resource against invasion by others. When some users of any type of resource system have entrepreneurial skill and are respected as local leaders as result of prior organization for other purposes, self- organization is more likely.
Payoff	Cost/Benefit	Users need to observe some scarcity before they invest in self-organization. Distribution of costs is proportional to benefits.
Governance		
Monitoring	Present Community Professional Monitor appropriation & condition of the resource	Due to the cost of observing and managing a system, self-organization is less likely with mobile resources. Group size is always relevant, but its effect on self-organization depends on other variables and the types of management tasks envisioned. Norms/social capital: Users of all types of resource systems who share moral and ethical standards regarding how to behave in groups they form, and thus the norms of reciprocity, and sufficient trust in one another to keep agreements will face lower transaction costs in reaching agreements and lower costs of monitoring.
Enforcement	Graduated response Accountable	Rapid, low cost arenas to resolve conflicts
Information:	Local Knowledge Flow for monitoring	When users share common knowledge of relevant system attributes, how their actions affect each other, and rules use in other systems, they will perceive lower costs of organizing.
Socio-ecological Setting		
External Drivers	Government Recognition of rights to organize	The long term sustainability of rules devised at a focal level depends on monitoring and enforcements as well as their not being overruled by larger government policies… Larger scale governance systems may either facilitate or destroy governance systems at a focal level.
	Economics	Market integration may effectively remove control of a resource from a user group… external integration alters local incentives, frequently by decreasing dependence on the resource used by a community… when members are not as dependent on the resource, their welfare is not as strongly tied to cooperative behavior.
	Nested enterprise	When a resource is connected to a larger socio-ecological system, governance activities are organized in multiple, nested layers. Establishing rules at one level, without rules at the other levels will produce an incomplete system that may not endure over the long term.

TABLE II-1: RESOURCE SYSTEM CHARACTERISTICS CONDUCIVE TO THE INTERNET'S SUCCESS[31]

In the beginning and for a significant period of development, the architects and users of the Internet were a fairly small, homogeneous set of engineers who shared norms, values, and a pragmatic problem-

31. ELINOR OSTROM, UNDERSTANDING INSTITUTIONAL DIVERSITY 259 (2005); Cox et al., *supra* note 27, at 15; Ostrom, *supra* note 17, at 422.

solving world-view. The perceived benefits expected from cooperation were quite large and non-commercial. The essential principle of the Internet was to allow local autonomy around a core set of communications protocols. The protocols were designed to resolve conflicts over resources in a low-cost manner (best effort, with the end-points responsible for dealing with the quality of output). The nature of the users and the resources system made it "easy" to decentralize decision-making and rely on distributed knowledge and assets to build the system.

These characteristics of the Internet resource system were reinforced by an external environment that was supportive. The most important external actor, the government, spawned the idea in the first place.[32] The Federal Communications Commission (FCC), which had regulatory authority over a closely related, essential complementary resource system on which the Internet was dependent, also made key decisions that supported the growth of an autonomous, decentralized resource system.[33] The Internet would not have functioned beyond a minimal scale without access to a key, related external resource system – the telecommunications network – that was the focal core communications resource system of the 2nd industrial revolution. The FCC instituted key policy decisions that forced the dominant incumbents in the telecommunications resource system to leave the Internet alone,[34] enabling the Internet to develop according to a radically different set of design and governance principles, while utilizing the existing communications resource system. I will elaborate on the importance of this point for the current debate over Internet governance in Section IV.

An important implication of these observations is that the unintended consequences of dramatic success can alter the internal and external relations of the resource system so much that the original conditions of success are no longer obtained. Thus, even a successful resource system must be able to adapt to change. Over the course of the youth and adolescence of the Internet resource system, its remarkable success transformed almost every one of those conditions. We now have a large number of much more diverse users spread over a vast geographic space creating an exaflood of much more complex and heterogeneous outputs. The complexity and heterogeneity challenge the predictability. Diversity reduces the sharing of norms. The expansion of the Internet as a communications resource system brings it into conflict with the telecommunications resource system on which it depended for its success. Commercialization changes the motivations of actors and their willingness to cooperate, leading some commercial interest to seek to completely overturn the constraint on telecommunications resource behavior that the FCC imposed.[35]

Challenges to predictability, norms, and cooperation trigger a search for new or "better" management mechanisms. Given the tendency to try to fit new relations into old laws, we should not be surprised to find many policy advocates turning to the state or the market to address the challenges. Yet, in significant measure the Internet succeeded because it was between the state and the market, utilizing tools from each to build a dynamic resource system based on a radically different communications principle.

B. The Basic Elements of Institutional Analysis

1. Building Success between the Market and the State

Both North and Ostrom locate their analytic frameworks between the market and the state based on a similar critique of neoclassic economic analysis and its overreliance on markets as the answer to every

---

32. *See generally* JANET ABBATE, INVENTING THE INTERNET (1999).

33. Robert Cannon, *The Legacy of the Federal Communications Commission's Computer Inquiries,* 55 FED. COMM. L.J.. 167, 169 (2003).

34. Lessig puts it bluntly: "Phone companies, however, did not play these games, because they were not allowed to. And they were not allowed to because regulators stopped them." LAWRENCE LESSIG, THE FUTURE OF IDEAS: THE FATE OF THE COMMONS IN A CONNECTED WORLD 148 (2001).

35. For a detailed outline of this conflict, *see* OPEN ARCHITECTURE AS COMMUNICATIONS POLICY: PRESERVING INTERNET FREEDOM IN THE BROADBAND ERA (Mark Cooper ed., 2003), http://cyberlaw.stanford.edu/attachments/openarchitecture.pdf

question and/or the solution to every problem. [36] Indeed, these two Nobel laureates provide the bookends for over a decade of Nobel prizes in economics that were given to scholars who demonstrated that the neoclassical approach to economics that dominated much of the 20th century was far too narrow.

Each framework argues that neoclassical economic analysis is so severely limited by its assumptions as to be restricted in its usefulness and counterproductive in the search for knowledge about change and stability across time. They identify a series of important situations/challenges that are not well suited to simple market solutions. Their analyses demonstrate that humans have much greater deliberative capacity and intentional ability to build organizations and institutions to meet economic challenges, so the resulting reality of economic life is far more complex than neoclassic theory admits.

The two frameworks share a similar schizophrenia about government. They are leery of government solutions from above/outside. External mandates have a tendency to make matters worse, not better, either because the outsiders do not have the necessary local knowledge to understand how to make the resource system work (and are too arrogant to ask) or because their interests are different from the local interests. However, both frameworks also recognize that meeting the challenge of building institutions/organization to solve economic problems requires supportive government action at some level, and the larger and more complex the resource system, the greater the need for governmental policy support.[37]

36. *See, e.g.*, AMY R. POTEETE, MARCO A. JANSSEN & ELINOR OSTROM, WORKING TOGETHER: COLLECTIVE ACTION, THE COMMONS AND MULTIPLE METHODS IN PRACTICE 217, 218, 220-22 (2010) ("The conventional theory was pristine in the simplicity of its model of human behavior but made strong assumptions about information conditions. Individuals are assumed to have complete information about the structure of the situation they are in, including the preferences of other actors, the full range of possible actions, and the probability associated with each outcome resulting from a combination of actions. Each individual is assumed to select the strategy leading to the best expected outcome for self. . . . Based on the conventional theory, many analysts thought that the *only* way to solve the commons problem was to impose a solution from the outside. Fortunately, scholars who conducted case studies of diverse resource systems all over the world were not blinded by the conventional theory. . . . The clear and unambiguous predictions derived from the conventional theory of collective action have been replaced with a range of possible outcomes, including some that are far more optimistic. . . . We need to recognize that what has come to be called rational-choice *theory* is instead one *model* in a family of models that is useful for conducting formal analyses of human decision in highly structured, competitive settings. . . . A broader theory of human behavior views humans as adaptive creatures who attempt to do well given the constraints and opportunities of the situation in which they find themselves (or the ones they seek out). Humans learn norms, heuristics, and full analytic strategies from one another, from feedback from the world, and from their own capacity to engage in self-reflection and imagine a differently structured world. They are capable of designing new tools—including institutions—that can, for good or evil purposes, change the structure of the worlds they face. . . . If, as we assume, decision making relies on learning and adaptation, other-regarding preferences and norms, and heuristics, then trust can play a central role in influencing the prospects for collective action.") (citation omitted). *See also* NORTH, *supra* note 15, at 5, 65 ("The rationality assumption has served economists (and other social scientists) well for a limited range of issues in micro theory but is a shortcoming in dealing with the issues central to this study. Indeed the uncritical acceptance of the rationality assumption is devastating for most of the major issues confronting social scientists and is a major stumbling block in the path of future progress. The rationality assumption is not wrong, but such an acceptance forecloses a deeper understanding of the decision-making process in confronting the uncertainties of the complex world we have created. . . . Neo-classical economic theory provides an understanding of the operation of markets in developed economies but was never intended to explain how markets and overall economies evolved. It has three fundamental deficiencies which must be overcome to understand the process of economic change. It is frictionless, it is static, and it does not take into account human intentionality.") (footnote omitted); NORTH, *supra* note 29, at 111, 112 ("There is in economics a (largely) implicit assumption that the actors can correctly identify the reason for their predicaments (i.e., have *true* theories), know the costs and benefits of . . . choices, and know how to act upon them. Our preoccupation with rational choice and efficient market hypotheses has blinded us to the implications of incomplete information and the complexity of environments and subjective perceptions of the external world that individuals hold. There is nothing the matter with the rational actor paradigm that could not be cured by a healthy awareness of the complexity of human motivation and the problems that arise from information processing. Social scientists would then understand not only why institutions exist, but also how they influence outcomes. . . . Integrating institutional analysis into *static* neoclassical theory entails modifying the exiting body of theory. . . . Path dependence is the key to an analytic understanding of long-run economic change. . . . [I]t extends the most constructive building blocks of neoclassical theory—both the scarcity/competition postulate and incentives as the driving force—but modifies that theory by incorporating incomplete information and subjective models of *reality* and the increasing returns characteristic of institutions. The result is an approach that offers the promise of connecting microlevel economic activity with the macrolevel incentives provided by the institutional framework. The source of incremental change is the gains to be obtained by organizations and their entrepreneurs from acquiring skills, knowledge, and information that will enhance their objectives." *Id.* at 112.) (internal citation omitted).

37. NORTH, *supra* note 15, at 122, 132-33 ("Economists of a libertarian persuasion have for some time labored under the delusion that there is something called laissez faire and that once there are in place 'efficient' property rights and the rule of law the economy will perform well without further adjustment. . . . Transaction costs—here measurement and enforcement costs—will vary in each case; in order to reduce such costs there must be an institutional structure that will provide incentives for the players to compete at those margins, and those margins alone, that will be socially productive. Typically this entails a set of formal (usually a mixture of laws, rules, and

North's description of how and when the supportive decisions of the state can provide critical support, rare as it is, identifies a pattern of action that I argue typified the behavior of the state in the context of the birth and youth of the Internet.

> In rare cases the government designs and enforces a set of rules of the game that encourage productive activity. . . . Because there is a widespread prejudice among many neoclassical economists that simply an absence of government intervention is a sufficient condition for good economic performance in a particular market, it is important to stress that the performance characteristics of any market are a function of the set of constraints imposed by institutions (formal rules—including those by government—informal norms, and the enforcement characteristics) that determine the incentive structure in that market. . . . The crucial point is to recognize that efficient markets are created by structuring them to have low costs of transacting and these conditions will vary with each kind of market and with each market over time. . . . Well-functioning markets require government, but not just any government will do. There must be institutions that limit the government from preying on the market. Solving the development problem therefore requires the crafting of political institutions that provide the necessary underpinnings of public goods essential for a well-functioning economy and at the same time limit the discretion and authority of government and of the individual actors within government. . . . [A]n underlying structure that credibly commits the state to a set of political rules and enforcement that protects organizations and exchange relationships.[38]

Ostrom's description of nested resource systems expresses a similar view:

> [O]fficials and policy analysts who presume that they have the right design can be dangerous. They are likely to assume that citizens are short-sighted and motivated only by extrinsic benefits and costs. Somehow, the officials and policy analysts assume that they have different motivations and can find the optimal policy because they are not directly involved in the problem (citation omitted). They are indeed isolated from the problems. This leaves them with little capability to adapt and learn in light of information about outcomes resulting from their policies. All too often, these "optimal" policies have Leviathan-like characteristics to them. . . . While smaller-scale, community-governed resource institutions may be more effective than centralized government in achieving many aspects of sustainable development, the absence of supportive, large-scale institutional arrangements may be just as much a threat to long-term sustenance as the presence of preemptive large-scale governmental agencies. Obtaining reliable information about the effects of different uses of resource systems and resource conditions is an activity that is essential to long-term sustainability. If all local communities were to have to develop all of their own scientific information about the physical settings in which they were located, few would have the resources to accomplish this. [39]

> Furthermore, the long-term stability of rules devised at a focal. . . level depends on monitoring and enforcement as well as their not being overruled by larger government policies. . . . Larger scale governance systems may either facilitate or destroy governance systems at a focal. . . level.[40]

Institutions located between the market and the state can ground their economic success (superiority) in a number of possible economic dilemmas. Ostrom has been closely associated with the debate over social organization to exploit common-pool resources and produce public goods,[41] but that is far from the only

---

regulations) and informal constraints to produce the desired results. . . . The mechanisms for contract enforcement appear to have had their beginnings in internal codes of conduct of fraternal orders of guild merchants, which were enforced by the threat of ostracism. These codes evolved into merchant law and spread throughout the European trading area; gradually they became integrated with common and Roman law and enforcement was eventually taken over by the state. The last point is critical. The economic institutional structure was made possible by the evolution of polities that eventually provided a framework of law and its enforcement.")(internal citation omitted).

38. *Id.* at 67, 76-77, 85, 105.

39. OSTROM, 256, *supra* note 31, at 278) (citation and footnotes omitted).

40. Elinor Ostrom, *A General Framework for Analyzing Sustainability of Social-Ecological Systems,* 325 SCIENCE 419, 422 (2009).

41. *See, e.g.*, Ostrom, *supra* note 17, at 408-09 ("Contemporary research on the outcomes of diverse institutional arrangements for governing common-pool resources (CPRs) and public goods at multiple scales builds on classical economic theory while developing new theory to explain phenomena that do not fit in a dichotomous world of 'the market' and 'the state.' . . . The market was seen as the optimal institution for the production and exchange of private goods. For nonprivate goods, on the other hand, one needed the government to impose rules and taxes to force self-interested individuals to contribute necessary resources and refrain from self-seeking activities.

economic dilemma that non-market institutions may be called on to address. North argues that the exploitation of knowledge poses a challenge that markets may not meet well and his list of challenges includes other well-known sources of market failure.

> Just how does it work? Sociologists looking empirically at information networks describe an immensely complicated communications structure that pulls the dispersed knowledge together in order to use it effectively in the growth of productivity of the modern economy. . . . It is only when that specialized knowledge can be integrated with other complementary knowledge at low cost that it is very valuable. The interconnections necessary to combine distributed knowledge effectively entail much more than an effective price system, although that is an essential prerequisite. The essential public goods, asymmetric information, and ubiquitous externalities require that institutions and organizations be created to integrate this dispersed knowledge. . . .[42]

The economic dilemma that the Internet navigates could be classified as a common-pool resource, a public good with a massive (positive) externalities or a transaction cost problem (asymmetric information plus others).[43] Any of these would provide a basis for concluding that there was an economic benefit that could be captured by cooperation. Or, it can be argued that the immense power of the Internet and its remarkably quick rise to dominance reflects the fact that it addresses **<u>all</u>** of these perennial sources of market failure in significant ways. The importance of the Internet resource system is magnified by the fact that communications and information flow are increasingly central to economic activity and have long been at the heart of important political and social processes. Thus, the Internet provides uniquely useful solutions to several increasingly important social/economic dilemmas. Failing to recognize the broad economic basis of the Internet's success seriously underestimates its value and power as a cooperative solution to important social and economic dilemmas.[44] More importantly, in order to avoid undermining the dynamic economic engine of the Internet in the process of responding to the maturation challenges, the rich and complex set of social and economic dilemmas it addresses must be considered.

As suggested by the above quotes, the challenge for institutional analysis has been to describe the rules that make resource systems work/economies perform well and to convince policymakers (among others) that the market or the state are not the only way to write effective rules. In the Internet space, we know the rules and the institutions. My goal is to understand why they worked so well and to caution policymakers that great care is needed in adapting them to the maturation challenges, lest the policies adopted undermine the ability of the resource system to continue it dynamic development. The proposed solution is to expand

---

Without a hierarchical government to induce compliance, self-seeking citizens and officials would fail to generate efficient levels of public goods . . . .")

42. NORTH, *supra* note 15, at 120-21. ELINOR OSTROM, ROY GARDNER AND JAMES WALKER, RULES, GAMES & COMMON-POOL RESOURCES (1994) at 193, 194, 217. "Policymakers responsible for the governance of small-scale, common-pool resources should *not* presume that the individuals involved are caught in an inexorable tragedy from which there is no escape. Individual may be able to arrive at joint strategies to manage these resources more efficiently. To accomplish this task they must have sufficient information to pose and solve the allocation problems they face. They must also have an arena where they can discuss their joint strategies and perhaps implement monitoring and sanctioning. In other words, when individuals are given an opportunity to restructure their own situation they frequently, but not always, use this opportunity to make commitments that they sustain, thus achieving higher joint outcomes without recourse to an external enforcer. . . ." But once individual communicate (especially if they can communicate with one another repeatedly), they can build up trust through their discussions and through achieving better outcomes. If individuals come to these situations with a willingness to devise sharing rules and to follow a measured reaction, then communication facilitates agreement selection and the measured reaction facilitates agreement retention.

43. *See, e.g.*, YOCHAI BENKLER, THE WEALTH OF NETWORKS (2006); Brett Frischmann, *An Economic Theory of Infrastructure and Commons Management,* 89 MINN. L. REV. 917 (2005). Benkler is most closely associated with the commons argument, although he has a very broad perspective; Frischmann emphasizes the externalities view.

44. Mark Cooper, *From Wifi to Wikis and Open Source: The Political Economy of Collaborative Production in the Digital Information Age*, 5 J. ON TELECOMM. & HIGH TECH. L. 125 (2006) (arguing that the digital economy goes beyond the traditional four good framework based on rivalry and exclusion because it creates a new type of good, collaborative goods – that increases in value because they exhibit antirivalry and inclusiveness. *Id.* "[C]ollaborative production goods occur where having numerous producers participate in the production of the goods increases its value and where the value of the good goes up as the number of people who use it increases." *Id.* at 133.).

and reinforce governance institutions between the market and the state.

2. Creating Resources by Increasing Predictability

Both North and Ostrom launch their analysis from the desire and need to analyze systems that generate resources for groups of humans because the production and distribution of economic resources are central to human life and wellbeing.

> The revolution in technology of the past several centuries has made possible a level of human well-being of unimaginable proportions as compared to the past, but it also has produced a world of interdependence and universal externalities, and in consequence a whole new set of uncertainties.[45]

The ultimate goal of social institutions/organizations is the reduction of uncertainty through cooperation to capture collective benefits that exceed the benefits available from individual action. Figure II-1 presents a summary of the comprehensive variables and processes that the IAD approach has derived from experimental and field studies of cooperative responses to economic dilemmas. Predictability of actions results from roles that are clearly defined by formal rules and informal norms as to who can do what, rules and norms that are well monitored and backed by enforcement mechanisms. Predictability is enhanced by providing incentives and enforcing constraints on activity with sanctions. Effective sanctioning that maintains the order tends to be graduated. Trust in the action of others is the key to predictability of action and lowering transaction costs. Information and communications are central to developing rules and enforcing them.[46]

Consistency/congruence across these levels and between the elements of each level is a key feature of a successful social response to a resource challenge.

Both of the frameworks are focused on the causes and responses to external and internal pressures for change and the ability of the institutions that humans have built to adapt.

> Successful economic development will occur when the belief system that has evolved has created a "favorable" artifactual structure that can confront the novel experiences that the individual and society face and resolve positively the novel dilemma. . . . Put simply the richer the artifactual structure the more likely are we to confront novel problems successfully. That is what is meant by adaptive efficiency; creating the necessary artifactual structure is an essential goal of economic policy.
>
> Adaptive efficiency . . . entails a set of institutions that readily adapt to the shocks, disturbances, and ubiquitous uncertainty that characterize every society over time. The foundation of these flexible institutions resides in widely held beliefs embodied in the informal constraints of the society.[47]

> In light of still further evidence about the performance of self-organized systems that are consistent with the earlier derived design principles, we can conclude that there are ways of organizing governance that increase the opportunities for adaptation and learning in a changing and uncertain world with continuing advances in knowledge and technologies. . . .
>
> The contemporary use of the term *robustness* in regard to complex systems focuses on adaptability to disturbances: "the maintenance of some desired system characteristics despite fluctuations in the behavior

---

45. NORTH, *supra* note 29, at 20.

46. Identifying similar vitally important social bases of action and gives an example that is relevant to the issues examined in this paper. *Id.* at 75 ("Norms of honesty, integrity, reliability lower transaction costs. . . . The traders from the Islamic world developed in-group social communication networks to enforce collective action. While effective in relatively small homogeneous ethnic groups, such networks did not lend themselves to the impersonal exchange that arises with the growing size of markets and diverse ethnic traders. In contrast, the Genoese developed bilateral enforcement mechanisms which entailed creation of formal legal and political organizations for monitoring and enforcing agreements—an institutional/organizational path that permitted and led to more complex trade and exchange.").

47. NORTH, *supra* note 15, at 69-70, 78.

of its component parts or its environment."[48]

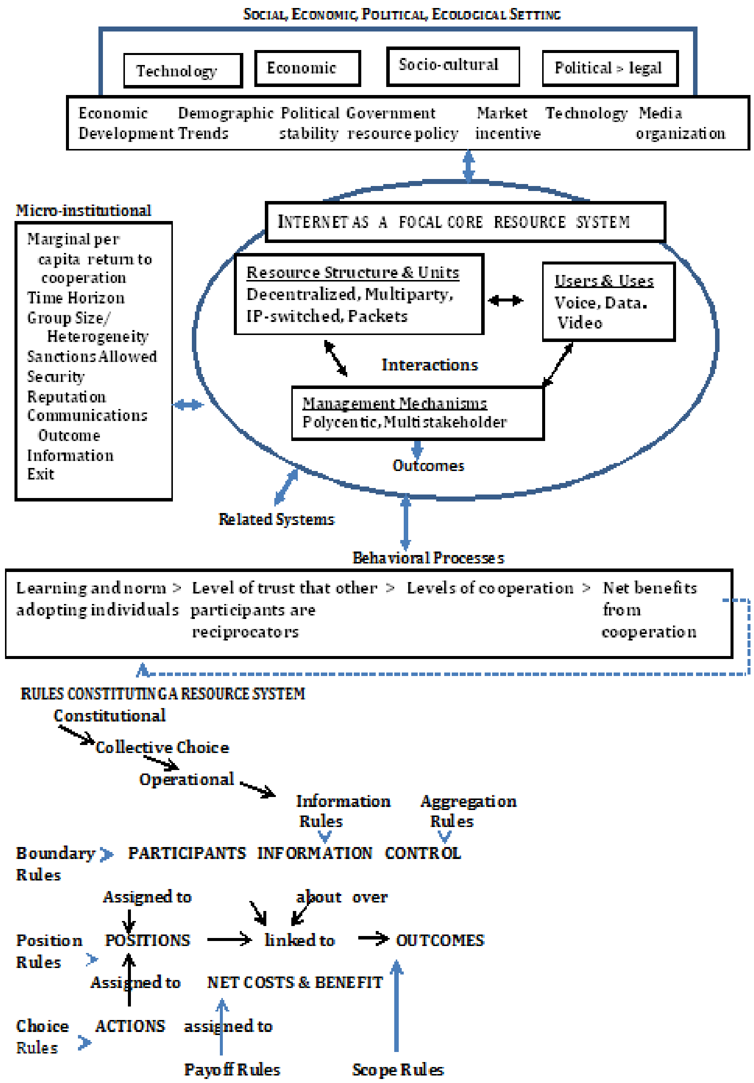


FIGURE II-1: VARIABLES AND PROCESSES THAT INFLUENCE THE DEVELOPMENT AND ADAPTATION OF THE INTERNET RESOURCE SYSTEM[49]

Change depends on the ability of the institutions to buffer themselves and the origin and nature of the forces creating the pressure for change. These pressures can be internal to the resource system (e.g., depletion of resources, conflicts over interpretation of rules) or external (e.g., external intervention, competition for scarce resources, change in the characteristics of the resource).[50]

48. OSTROM, *supra* note 31, at 257, 258.

49. MARCO A. JANSSEN ET AL., WORKING TOGETHER: COLLECTIVE ACTION, THE COMMONS AND MULTIPLE METHODS IN PRACTICE (2010);, Elinor Ostrom, *A General Framework for Analyzing Sustainability of Socio-Ecological Systems*, SCIENCE MAGAZINE, July 24, 2009, at 24; Nives Dolsak & Elinor Ostrom, *The Challenge of the Commons*, *in*, THE COMMONS IN THE NEW MILLENNIUM: CHALLENGES AND ADAPTATION, (Nives Dolsak & Elinor Ostrom eds. 2003).

50. NORTH, *supra* note 29 (noting a number of sources of change including: the inevitable imperfection of understanding of realty, *id.* at 2, the fit between the institutions and reality, *id.* at 3, complexity, *id.* at 23, processes by which human activity changes the environment in which institutions exist, *id.* at 116, and entrepreneurship, *id.* at 125); *see also* Elinor Ostrom and Xavier Basurto, *Crafting*

C. The Internet as a Focal Core Resource System

1. The Elements of the Internet Resources System

To study this complexity one must examine the formal and informal rules of social institutions and organization that humans develop to increase the predictability of behavior. As shown on the left side of Figure II-1, above, the resource system can be conceptualized as composed of three aspects or sets of elements—the structure and units, users and uses, and the management mechanism—that interact to produce the outcome. The resource system is embedded in a socio-ecological setting and supported by behavioral processes.

In Figure II-1, above, I modify Ostrom's basic set of definitions in two ways. First, I combine the structure and units into one aspect of the resource system that captures the generally technical nature of the system. Second, the aspect that I label management mechanism is called the governance system by Ostrom. Ostrom used the term governance system broadly to include the decisions and choices made about the constitution of the resources system. The Internet governance debate has come to use the term governance even more broadly to apply to both the management of the resource and the host of issues that arise from the socio-ecological setting.

This distinction is well-recognized in the Internet governance debate. For example, a paper from the United Nations Conference on Trade and Development (UNCTAD) noted:

> It is important in this regard to distinguish "governance of the Internet" (that involves the physical and logical infrastructure of the Internet, and would probably be more appropriate to refer to as the management of the core resources of the Internet) from "governance on the Internet" (which concerns activities that take place over the Internet, particularly the exchange of information, goods and services).[51]

Throughout the remainder of the paper, I use the term Internet governance to refer to the very broad set of issues that have arisen in the international debate about the future of the Internet, while I reserve the term management mechanisms for the narrower questions of the operation of the structure, units, users, and uses of the resource system.

As shown on the right side of Figure II-1, the resource system produces beneficial outcomes by institutionalizing rules that govern the resource. There are three broad categories of rules that define a resource system.

- Constitutional rules govern the way the overall resources system is constituted, particularly how collective choice rules are defined.
- Collective choice rules embody the procedures by which the operational rules are changed.
- Operational rules govern the activities that take place within the borders of the resource system. There are seven operational rules that define the resource system by assigning participants to positions that are associated with actions that yield payoffs, subject to monitoring and control.

The central question posed by North is at the operation level, "just how does it work?" It can be answered in terms of Figure II-1 as follows. The Internet is a resource system in which anyone can do anything as long as it comports with the Internet protocols (IP). The protocols create a flow of resource units continuously. They place no restrictions on content. If there is congestion, the users are told to back off and each knows what needs to be sent to complete the communication. Users have the opportunity to design their uses or operate their networks in ways that can deal with the capacity of the system to handle traffic. Decentralized, user-based, local knowledge is allowed to play a large role in the resource system,

---

Analytic Tools to Study Institutional Change, 327 J. INSTITUTIONAL ECON., 317, 324-27 (2011) (outlining various processes of rule change).

51. United Nations Conference on Trade and Dev. (UNCTAD), *Internet Governance*, *in* Internet Governance: A Grand Collaboration 256 (Don MacLean ed., 2004) [hereinafter *UNCTAD*].

another important characteristic that enables it to produce large benefits. The success of the system encourages the community of users to invest substantially in its maintenance and expansion. There may be some uses that the resource system is not well-suited for, but there are always work-arounds, and the vast array of activities that it came to support swamped the things it could not do precisely because there is so much freedom for users to figure out how to get things done.

The essence of the Internet resource system came to be described as a series of layers configured as an hourglass, as depicted in Figure II-2 by the National Academy of Sciences. The description that has become common is that the unique, revolutionary idea of the hourglass is that the protocols and standards at the waist enable any network in the bottom strata to communicate with every other network in the bottom strata, regardless of the application used, as long as the communication adheres to the protocols and standards at the waist. Interestingly, the hourglass can be described as two sections connected by a channel, which better fits the idea of information flows. The functionality of the hourglass lies in the fact that the two sections can contribute to the system functioning as the source of the flow is renewed with the turning over of the glass. This highlights a key characteristic of the Internet. It can be argued that networks and applications are strong complements in the creation of a successful resource system, and it is fair to say that the success of the Internet resource system reflects the "equal" contribution of the two sections – content and networks; hardware and software.

2. Networks as Resource Systems

With the Internet defined as a network of networks, it is not surprising that analysts of the Internet governance issue frequently adopt network theory as a framework. Network theory is virtually identical to the analytic framework that I have outlined in this section. As Mueller described networks, the quality of being between market structures and hierarchical structure is an essential characteristic of a network.

> A network was said to be based on *the relationship* rather than *the transaction*; it was composed of longer-term bonds of reciprocity and trust among economic actors that were too stable to be classified as market transactions and too loose to be classified as formal hierarchies.[52]
>
> The economic advantage of the network flows from the characteristics of the network that allow it to utilize local knowledge.
>
> Many of the advantages attributed to this form of organization were related to its efficiency in sharing and processing information and knowledge. Networks were characterized as relying on lateral as opposed to hierarchical channels of communication, which made it possible to more efficiently exploit complementary skills and knowledge dispersed among multiple actors. As learning and innovation vehicles, network organizations compared favorably to "passing information up and down a corporate hierarchy or purchasing information in the marketplace" because they facilitated the development of "new interpretations" and "novel linkages," and took advantage of the unique economics of information, in that sharing does not deplete it. . . . Based on the preceding discussion, it now is easier to see how the Internet triggers an explosion of new kinds of network organization and peer production processes; and also how the Internet enables a vast expansion of transnational issue networks or policy networks.[53]

It is interesting to note that in answering the crucial question of how to account for innovation and change, Mueller turns to the process of institutionalization and cites North and Ostrom. The description of the network structure and dynamics fits the resource system framework, in general, and the Internet, in particular, quite well.

52. MUELLER, *supra* note 19, at 34.
53. *Id.* at 45.

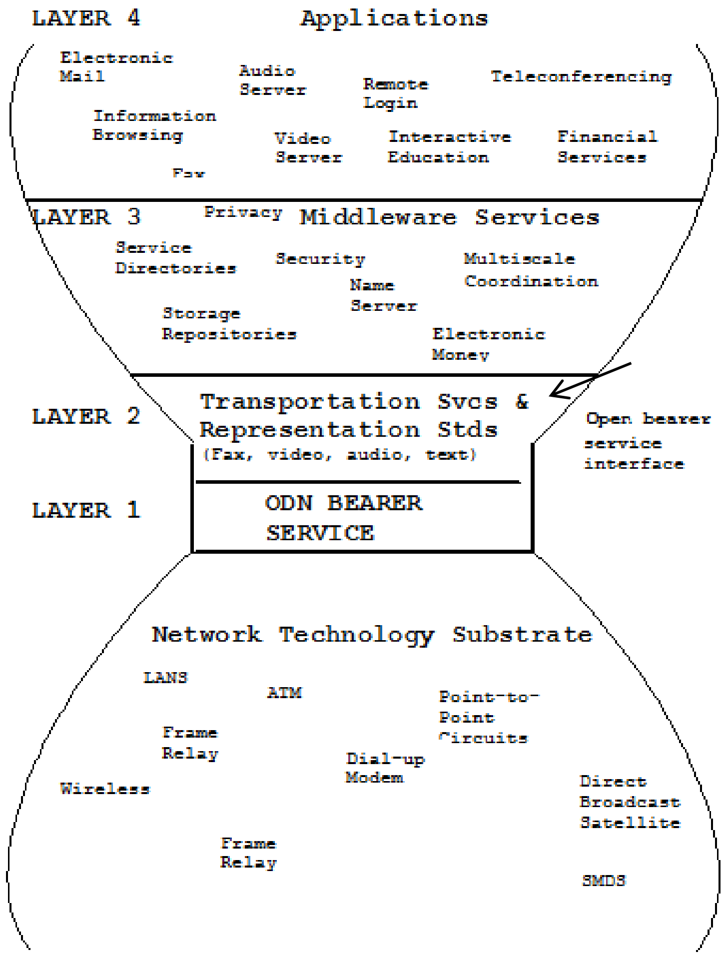


FIGURE II-2: THE INTERNET HOURGLASS AT THE HEART OF THE RESOURCE SYSTEM[54]

How might this result in innovation and change in the governance of communications and information?

At this juncture it becomes useful to link discussions of networks more directly to theories of institutions and institutionalization. When considering Internet governance we need to pay attention to the movement from informal, de facto association to formal organization; from loose consensual or cooperative action to the adoption of binding, agreed procedures. It is precisely this movement from the partially institutionalized to the formally structured that is the most critical and revealing part of the global politics of Internet governance.

Institutionalization implies that the parties involved in regular interactions understand and accept certain norms, conventions, and explicitly formulated rules governing their interaction, and that these rules can be enforced. This results in what game theorists call equilibrium outcomes, or stable patterns of interaction that reproduce and reinforce the rules and the organizational roles as the precondition for action. Mutual agreement on applicable rules and roles can generate collective benefits. Institutional theory suggests, however, that it is conflict or negotiation over the *distribution* of these benefits that moves loose associations of actors along the spectrum ranging from very informal, associative networks to more formal organization, and from there to the most hierarchical and binding forms of institutionalization.[55]

54. NATIONAL RESEARCH COUNCIL, REALIZING THE INFORMATION FUTURE 3 (National Academy Press 1994), *available at:* http://www.scientificcomputing.com/news-HPC-Internet-Architectures-Hourglass-Shape.aspx (updated version).
55. MUELLER, *supra* note 19, at 35, 45-46.

Pavan's formulation is similar:

> This focus on interaction is justified by a "decentralized concept of social organization and governance [for which] the society is no longer exclusively controlled by a central intelligence (e.g. the state); rather controlling devices are dispersed and intelligence is distributed among a multiplicity of action (or 'processing') units." . . . [G]iven the features of dynamism and complexity that characterize the global context, new approaches are needed to investigate the plurality of actors *and* interaction in which they engage . . . . To this end, networks are a powerful image for portraying the growing complexity of contemporary societies. . . . [N]ot only do networks constitute a lens for depicting and reducing the complexity of the situation, but their emergence is nowadays also considered a relevant political result . . . . Networks are preferred to markets and hierarchies as modes of organizing political processes with specific reference to three aspects: *the relations established between actors,* which are pluricentric as opposed to monocentric, entailed by state regulation and multicentric arrangements characterizing market competition; *the decisional mechanisms enacted,* which are based on reflexive rationality rather than on the substantial rationality characterizing state regulation or on the procedural rationality defined by markets; and finally, *the level of compliance with collectively negotiated decisions,* which is ensured not by means of coercion typical of the state or by the "*fear of economic loss"* but rather through the generation of trust and political obligation. In sum, network arrangements are adopted because steering activities about complex matters require the simultaneous presence of diverse actors and competencies: it is along network ties that participants' points of view can be coordinated and consensus is possibly achieved.[56]

56. PAVAN, *supra* note 19, at 44, 48 (citations omitted). Drawing on the works of Buchanan, MARK BUCHANAN, NEXUS: SMALL WORLDS AND THE GROUNDBREAKING SCIENCE OF NETWORKS (2002), Barabási, ALBERT-LÁSZLÓ BARABÁSI, (LINKED: HOW EVERYTHING IS CONNECTED TO EVERYTHING ELSE AND WHAT IT MEANS FOR BUSINESS, SCIENCE, AND EVERYDAY LIFE (2003), and Watts, DUNCAN J. WATTS, SIX DEGREES: THE SCIENCE OF A CONNECTED AGE (2003), I argue that decentralized, distributed network have unique efficiency characteristic that I call "[T]he principle of distributed efficiency . . . in which important shortcuts bypass hubs that have become congested or overburdened and allow nodes to communicate. . . . Important shortcuts (bridges) meet the criteria of reducing traffic between neighboring hubs that are already in communication through a third hub. By adding bridges to the decentralized network, it gains the characteristics of a distributed network. . . . (1) By adding links at the periphery, congestion of the core is reduced. Communications capabilities are distributed to the nodes or end points. (2) The additional links can relieve a great deal of traffic that had flowed through the central hub (c). Therefore, the network should have the necessary resources to free up to form the new links. (3) Moreover . . ., all clusters could communicate with one another . . . . (4) Under routine functioning, no node is separated by more than two degrees (one link, one bridge) from any other hub. (5) Under stress, should any module be removed, no node is more than three steps (one link, two bridges) from any other hub. (6) No matter how many modules are taken out, all the remaining nodes can continue to communicate although it becomes more difficult since each communication must traverse more bridges. While we tend to '"see'" networks as nodes and hubs and measure them by counting the quantity or assessing the quality of messages that flow between them, the architecture of the network is dictated by the rules of communications and connectivity. In the robust, efficient network, information flows because it can (connectivity) and should (functionality). The architecture makes the observed pattern of communications between nodes and hubs possible. . . . The hierarchical, modular network that exhibits both decentralized and distributed communications traits allows experimentation at the periphery, without threatening the functionality of the network. (citation omitted). Failure is not catastrophic; since it can be isolated and its impact minimized. Success can be pursued independently and exploited because of efficient communications. Successful nodes grow more rapidly through preferential attachment. . . . " Cooper, *infra* note 76, at 120, 122-23 (citation omitted). "Watts . . . identif[ies] searchability as a critical and '"generic property of social networks.'" Searchability is facilitated by paying attention to one's neighbors (chosen by preferential attachment). As he puts it: "By breaking the world down the way we do – according to multiple simultaneous notions of social distance – and by breaking the search process itself down into manageable phases, we can solve what seems to be a tremendously difficult problem with relative ease. Searchability is one of the key advantages of multiscale networks because '"in ambiguous environments, information congestion related to problem-solving activities causes individuals – especially those higher in the hierarchy – to become overburdened. The local response of these individuals is to direct their subordinates to resolve problems on their own by conducting directed searches.'" Watts argues that '"[w]hen problem solving is purely local, requiring messages to be passed between members of the same work team, for example, or subscribers to the same ISP, congestion can be relieved effectively by a process that corresponds to *team building*." *Id.* at 124.

FROM WIFI TO WIKIS AND OPEN SOURCE: THE POLITICAL ECONOMY OF COLLABORATIVE PRODUCTION IN THE DIGITAL INFORMATION AGE

MARK COOPER

INTRODUCTION

In August 2005, *Wired* magazine's cover story stated that collaborative production is the near future's "main event."[1] *Wired*, marking the 10th anniversary of the initial public offering of Netscape, also declared that a revolution was occurring that penetrates to the core of daily life with the transformation of consumers into producers.[2] Among the evidence of this transformation is hyperlinking, which creates the electricity for "ordinary folks to invest huge hunks of energy and time into making free encyclopedias, creating public tutorials for changing a flat tire, or cataloging the votes in the Senate."[3] *Business Week* confirmed this transformation when it ran a similar story a month later with the headline, "It's A Whole New Web."[4]

In the presence of digital computer/communications platforms, the dramatic growth of collaborative activities constitutes the emergence of a new mode of information production based on the superior economics of collaborative production. This new mode of production challenges fundamental concepts of the role and function of property and commercial relationships in the production of information goods. However, to develop definitions of and describe the success of collaborative production, the definition of public goods and common pool resources must be extended.[5] This is because although public goods and common pool resources exhibit traits of non-rivalry and non-excludability, collaborative goods exhibit characteristics of anti-rivalry and inclusiveness.[6] In addition, concepts such as commons and non-commodified relations must be included to understand fully the dynamics of collaborative production.

The dramatic success of collaborative networks poses a challenge, not only to the dominant economic paradigm, but also to a broad range of received social science thinking.[7] Traditional economic analysis hypothesized that large producers would reap the benefits of network externalities by tracking usage and targeting users with a form of cyberspace direct mail on steroids combined with instant point and click gratification that would deliver sales of large, bundled packages.[8] Sociologists feared an acceleration of

---

[1] K. Kelly, *10 Years That Changed the World*, WIRED, August 2005, at 132.
[2] *See* Yochai Benkler, *From Consumers to Users: Shifting the Deeper Structure of Regulation Toward Sustainable Commons and User Access*, 52 FED. COMM. L.J. 561, 562 (2000) (providing an early, scholarly discussion of the transformation of consumers into producers).
[3] Kelly, *supra* note 1.
[4] Robert D. Hof, *It's a Whole New Web*, BUSINESS WEEK, Sept. 26, 2005, at 79.
[5] The most prominent example of open source software, Linux, "ought to be at the worse end of the spectrum of public goods because it is subject additionally to "collective provision." STEVEN WEBER, THE SUCCESS OF OPEN SOURCE 5 (2004).
[6] *Id*. at 154 (introducing the concept of antirivalness).
[7] Peter Levine, *The Internet and Civil Society: Dangers and Opportunities*, INFORMATION IMPACTS MAGAZINE, May 2001 (expressing concern over the decline of face-to-face relations); Peter Levine, *Can the Internet Rescue Democracy? Toward an ON-Line Commons*, *in* DEMOCRACY'S MOMENT REFORMING THE AMERICAN POLITICAL SYSTEM FOR THE 21ST CENTURY (Ronald Hayuk and Kevin Mattson eds., (2002); S. COLEMAN & J. GOTZE, BOWLING TOGETHER: ONLINE PUBLIC ENGAGEMENT IN POLICY DELIBERATION (2002) (regarding social relations).
[8] Y. Bakos & E. Brynjolfsson, *Bundling and Competition on the Internet: Aggregation Strategies for Information Goods*, 19 MKTG. SCI. 63, (2002).

isolation in the *Bowling Alone* syndrome,[9] as the focal point of interaction shifted from the face-to-face physical world to the anonymous, fleeting interactions in cyberspace.[10] Political scientists, applying the *Logic of Collective Action,* expected collaborative processes to break down under the weight of free riders.[11]

There is mounting evidence, however, that they were all wrong, as new forms of collaboration bind people together in productive, social, and economic relations to produce and self-supply an increasing array of micro-products that meet their needs.[12] The ever-declining costs of digital production and distribution have thwarted the predicted dominance of large bundles of information goods.[13] Large numbers of producers have seen increasing returns by hooking up with large numbers of consumers to sell differentiated products in two-sided markets or, better still, by consumers becoming producers in technology-facilitated environments.[14] People are no longer passive participants in the economy, as they were in the media available in the 20th century.[15] When offered the opportunity to participate and communicate in the digital information age, people quickly accept.[16] The potential for collective action was far greater than anticipated.[17] As a result, group formation has been widespread due to the high value of heterogeneity and the ability of people to see and act on shared interests in a non-commodified digital space that facilitates communication.[18]

To fully understand the emergence of collaborative production, this paper extends familiar economic concepts to make an adjustment of the existing economic rationale for bringing information 'under a legal regime of property rights' to accommodate the notion of collaborative production.[19] Information products, in the traditional framework of market structure, are not simple private goods. Spectrum is a common pool resource and communications facilities are public goods.

In the structural view of industrial organization[20] and the institutional view of economics[21] adopted in this paper transaction costs play a key role. Structural analysis teaches that when basic economic conditions change as dramatically as they have in the past couple of decades, society should not be surprised to find fundamental changes in economic structure, conduct, and performance. Institutional economics focuses on cooperation and transaction costs as a challenge to economic systems.[22] Institutional analysis argues that in addition to the costs of production – the supply-side transformation costs in the economy – transactions are a central part of the total cost. Indeed, transaction costs are of equal, if not greater, importance than the transformation costs of production processes, especially when services become the focus of the economy. Above all, humans struggle "to solve the problems of cooperation so that they may reap

---

[9] *See* ROBERT D. PUTNAM, BOWLING ALONE: THE COLLAPSE AND REVIVAL OF AMERICAN COMMUNITY (2000) (arguing that isolation and solitary activities had diminished the value of social capital).
[10] Peter Levine, *The Internet and Civil Society*, 20 REP. INST. PHIL. & PUB. POL'Y 1, 2 (2000).
[11] *See* MARCUR OLSEN, THE LOGIC OF COLLECTIVE ACTION (1965).
[12] *See* Arthur Lupia & Gisela Sin, *Which Public Goods Are Endangered? How Evolving Communications Technologies Affect The Logic of Collective Action*, 117 PUB. CHOICE. 315 (2003) (regarding collective action); *See also* COLEMAN & GOTZE, *supra* note 7.
[13] Hal R. Varian, *Copying and Copyright*, 19 J. ECON. PERSP. 121, 122 (2005).
[14] Glenn Ellison & Sara Fisher Elision, *Lessons about Markets from the Internet*, 19 J. ECON. PERSP. 139, 140 (2005).
[15] Kelly, *supra* note 1; Hof, *supra* note 4.
[16] *See* COLEMAN & GOTZE, *supra* note 7.
[17] *See* Lupia & Sin, *supra* note 12, at 315.
[18] The phenomenon includes everything from AOL buddy lists to MySpace friends, to the Wikis and collaborative activities. Kelly, *supra* note 1; Hof, *supra* note 4.
[19] This article uses the definition of intellectual property created by William Landes and Richard Posner: "ideas, inventions, discoveries, symbols, images, expressive works (verbal, visual, musical, theatrical), or in short any potentially valuable human product (broadly, "information") that has an existence separable from a unique physical embodiment, whether or not the product has actually been "propertized," that is, brought under a legal regime of property rights." WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 1 (2003).
[20] FREDERIC SCHERER & DAVID ROSS, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE (3d ed. 1990).
[21] DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE 3 (1990).
[22] Both sides of the debate over spectrum governance claim Coase as a forefather, in part because of his critique of the Federal Communications Commission management of spectrum. *See* R.H. Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1 (1959).

the advantages not only of technology, but also of all the other facets of human endeavor that constitute civilization."[23]

I. ANALYTIC FRAMEWORK

A. Traditional Public Goods

1. Characteristics of Traditional Public Goods

Economic analysis recognizes that under certain conditions competitive markets do not produce socially desirable outcomes.[24] In the case of public goods and externalities, the problem is not a lack of competition, but the inability of profit-driven market transactions to produce the goods or capture the values that best serve society. Markets with externalities and markets with public goods are "not likely to allocate resources efficiently, even though they might otherwise be competitive."[25] Externalities occur when the market price does not reflect the costs or benefit to the consumer or producer or others, not party to the transaction.[26] Public goods benefit all consumers, "even though individuals may not pay for the costs of production."[27] Both externalities and public goods affect the invisible hand theory in that it "may not guide the market to an economically efficient amount of production."[28]

These market failures occur where goods lack the critical characteristics that enable transactions in private property. (See Exhibit 1). In the neoclassical paradigm, scarcity is about rivalry and property is about exclusion. As Landes and Posner note, "[a] property right is a legally enforceable power to exclude others from using a resource."[29] A private good is **rivalrous** since "consumption by one person reduces the quantity that can be consumed by another person"[30] and **exclusive** since "consumers may be denied access."[31]

The central claim for the superiority of private goods is that where resources are rivalrous or subtractable, efficiency requires they be devoted to their highest valued use.[32] Exclusion gives the owner of the resource the incentive to husband the resource, especially where investment is necessary to replenish it.[33] Market allocation solves the subtractability problem by directing resources to their highest value uses.[34] The classic "tragedy of the commons" is the case where the failure to grant rights of exclusion leads to either under investment in the resource or overuse.[35]

When rivalry and excludability conditions are absent, the provision of goods in markets becomes problematic, particularly for private firms. **Nonrivalry** occurs where increased consumption of a good by one person does not decrease the amount available for consumption by others.[36] Here allocation does not promote efficiency, since consumers do not consume anything in the traditional sense and there is no scarcity to allocate. **Nonexcludability** means the consumers are not economically prevented from consumption either because the producer surplus is eaten up by the difficulty of exclusion or compensation cannot be

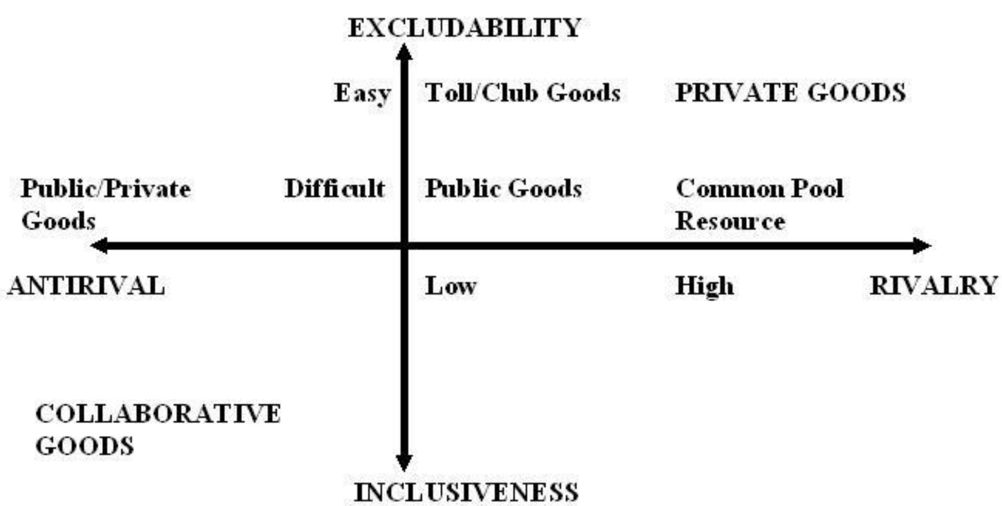
---

23 NORTH, *supra* note 21, at 118-33.
24 DAVID BESANKO & RONALD R. BRAEUTIGAM, MICROECONOMICS: AN INTEGRATED APPROACH 727 (2002).
25 *Id.*
26 *Id.*
27 *Id.*
28 *Id.*
29 LANDES & POSNER, *supra* note 19, at 12.
30 BESANKO & BRAEUTIGAN, *supra* note 24, at G-7.
31 *Id.*
32 JOHN B. TAYLOR, ECONOMICS 184 (1998).
33 *Id.* at 48.
34 *Id.* at 184.
35 *Id.* at 481.
36 *Id.* at 407.

extracted from “free riders.”[37] Exclusion is valueless and there is little incentive to invest.

This gives rise to the familiar typology of goods shown in the upper right hand quadrant of Exhibit 1. Note that I present the two characteristics as continua to underscore the absence of sharp dividing lines. Goods are more or less rivalrous and excludable. There is no precise point where they pass from being a private good to a public good.

Exhibit 1: Characteristics Of Collaborative Goods



A public good exhibits *nonrivalry in consumption* and *nonexcludability*.[38] When producers cannot exclude individuals from consuming their good, the individuals using the good for free may withhold their support for the good, seeking a free ride. Where the costs of exclusion are high, the cost may outweigh the value of the good. This prevents producers from providing public goods, even when those goods are beneficial to the public.

There are additional problems in private provision. Transactions may not take place for a variety of reasons such as excessive transaction costs or the inclination to try to “hold-up” transactions, seeking a larger share of the rents.[39] There is the “tragedy of the anti-commons” – the excessive fragmentation of property rights preventing transactions from taking place.[40] In this case, which might be considered a condition of excessive rivalry, producers and consumers cannot execute transactions as the institutional arrangement creates such huge transaction costs and problems.

Common pool resources (CPR) and their associated governance rules have also received increasing

---

[37] *Id.* at 407.
[38] *Id.* at 406.
[39] ERIK G. FURUBOTN & RUDOLF RICHTER, INSTITUTIONS AND ECONOMIC THEORY: THE CONTRIBUTION OF THE NEW INSTITUTIONAL ECONOMICS 131, 139 (2000).
[40] Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621, 622 (1998).

attention.[41] These resources are non-excludable, but they are rivalrous. The solution to the problems associated with common-pool resources is not necessarily private property, though. "If exclusion costs are comparatively high, common ownership solutions may be preferable."[42] The possibility of co-existence of different governance regimes is particularly important for common-pool resources because many CPRs incorporate characteristics of private and public goods.[43] In some instances, this is known as the "comedy of the commons."[44] The "comedy of the commons" is the opposite of the "tragedy of the commons" – the notion that users of commonly held property such as forests, fisheries, and most notably air, work together to ensure that overexploitation does not occur.[45]

2. Traditional Goods and the Technology Sector

Traditional public goods have played a particularly large role in the communications space. For centuries, society has treated communications networks as infrastructural, public goods. However, the distinctively American approach to the provision of these projects was to blend private capital with public interest obligations. Deemed to be "affected with the public interest," privately built communications networks first took the form of common carrier regulation and later took on price, quantity, and entry regulation.

Typically, infrastructure is a large investment that affects many aspects of the economy and exhibits substantial economies of scale.[46] Costs decline as more people use the infrastructure and the value of the economic activity it supports expands. Given the size of the investment and the need to expand consumption over a long period, it is difficult for private developers to realize an adequate return on such projects. The number of suppliers is likely to be limited. A natural monopoly, or at best a duopoly, develops – that is if any producer enters the market.

As an empirical matter, there are five clear linkages between communication infrastructure and public goods. First, infrastructure generates positive externalities by stimulating economic activity; public goods capture externalities that private, market transactions cannot.[47] Second, as a practical matter, for most of their economic life, infrastructure projects tend to be un-congested and non-rivalrous, especially in low-density, low-income areas.[48] Third, traditionally, society makes communications infrastructure a matter of public policy because private developers are unlikely to provide needed communication infrastructure adequately.[49] Fourth, because communications infrastructure networks connect people, the value of the network grows as more people connect to it.[50] Finally, communications networks traditionally receive special treatment from the government with franchises, subsidies, or special contracts.[51]

B. Collaborative Goods

Although it is certainly possible to analyze communication and information goods in the traditional

---

[41] *See, e.g.*, Charlotte Hess & Elinor Ostrom, *Artifacts, Facilities, and Content: Information as a Common-Pool Resource*, 66 LAW & CONTEMP. PROBS. 111 (2001).
[42] FURUBOTN & RICHTER, *supra* note 39, at 101.
[43] *Id.* at 102.
[44] *See* Carol Rose, *The Comedy of the Commons: Commerce, Custom and Inherently Public Property*, 53 U. CHI. L. REV. 711 (1986).
[45] ELINOR OSTROM, ROY GARDNER & JAMES WALKER, RULES, GAMES & COMMON-POOL RESOURCES bookjacket (1994).
[46] ALFRED. E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS 11 (1988).
[47] TAYLOR, *supra* note 32, at 598.
[48] Brett M. Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 MINN. L. REV. 917, 952 (2005).
[49] *Id*.
[50] BESANKO & BRAEUTIGAM, *supra* note 24, at 200.
[51] For an account of the early history of the telegraph and telephone in America which includes examples of various types of special treatment, *see* ALAN STONE, PUBLIC SERVICE LIBERALISM: TELECOMMUNICATIONS AND TRANSITIONS IN PUBLIC POLICY (1991).

framework of public goods, in the emerging information economy there must be an expansion of the underlying economic concepts used to define these goods.[52] The emergence of collaborative production on a large scale suggests something more, something different from common-pool resources and public goods.

Similar to public goods which represent a collective decision to provide an input for communications infrastructure, collaborative production entails a production process in which private appropriation of shared resources is accomplished.[53] However, collaborative production is a continuous direct relationship between producers outside the traditional market place. It is genuine joint production, not the collective supply or management of an input for private appropriation.

Collaborative production goods exhibit traits of anti-rivalry and inclusivity. The key characteristics of collaborative production goods occur where having numerous producers participate in the production of the goods increases its value and where the value of the good goes up as the number of people who use it increases. All three examples, discussed in greater detail later in this paper, wireless mesh networks, open source software and peer-to-peer networks exhibit these characteristics.[54]

Anti-rivalry occurs when the use and/or sharing the production of the good by one person increases the value of the good to others.[55] **Inclusiveness** occurs when the value of a good increases as the number of people using and/or producing the good increases.[56] Eric von Hippel's work on user driven innovation and free revealing reinforces the distinction between anti-rivalry and inclusiveness.[57] He identifies a **private/collective** good as a good for which individuals volunteer to support the supply of the good to the community of producers.[58] This provides a nuanced difference from a common pool resource in that an independent private action produces the resource for the community.[59] Innovators freely reveal private effort because they can "*inherently* obtain greater private benefits than free riders."[60]

In the information economy, just as it is necessary to distinguish between anti-rivalry and inclusiveness, it is also necessary to distinguish between inclusiveness and **network effects.** Network effects, also known as demand side economies of scale, occur when the costs of producing or the benefits of consuming a good spill over onto those who are producing or consuming the good, beyond the transaction.[61] The benefits of the network effect accrue to members of the network, directly or indirectly. The classic example of a direct network effect is a telephone. The value of the telephone grows as the number of people on the network increases due to the increasing number of reachable people. The classic example of an indirect network effect is software. The value of an operating system goes up as the number of people using it increases because more companies produce applications for it. Although there is no direct connection between the members of the network, the benefits still accrues to network members.

Frischmann argues for an additional distinction "between network effects and infrastructure effect."[62] The externalities of public and social infrastructures are diffuse because they "positively affect the

---

[52] *See* MARK COOPER, MAKING THE NETWORK CONNECTION, IN OPEN ARCHITECTURE AS COMMUNICATIONS POLICY (Mark Cooper ed. 2004).
[53] WEBER, *supra* note 5.
[54] Although I believe the two characteristics are separate, some believe the two are the same. *See id*.
[55] *Id*.
[56] CARL SHAPIRO & HAL VARIAN, INFORMATION RULES 178-84 (1999) (emphasizing demand side economies of scale and network externalities, which drives toward the concept of inclusiveness argued here).
[57] ERIC VON HIPPEL, DEMOCRATIZING INNOVATION 91 (2005).
[58] *Id.*
[59] *Id.*
[60] *Id.*
[61] BESANKO & BRAEUTIGAM, *supra* note 24, at 199-200.
[62] Frischmann, *supra* note 48, at 973.

utility of nonusers, that is, members of society who are not using the infrastructure itself also benefit."[63] Frischmann gives both a social and economic example of these diffuse externalities.[64] Socially, the increase in political discourse among Internet users also benefits non-users.[65] Economically, the increase of fertilizer due to an irrigation project increasing agricultural output affects distant fertilizer plants.[66]

David Reed describes two characteristics of adaptive network architectures in the spectrum that parallel the concepts of anti-rivalry and inclusiveness.[67] The first characteristic, cooperation gain, is the focal point of his analysis.[68] Cooperative gain, much like the anti-rivalry principle identified earlier, is the phenomenon where "[c]ompared to systems of dedicated, isolated links, networks provide much more transport capacity at much greater transport efficiency… [creating] major economic benefits."[69] The second characteristic is network optionality.[70] Network optionality, much like the inclusiveness principle discussed above, comprises two network externalities.[71] First, the "system-wide option value of flexibility in a network scales proportionally to the square of the number of nodes."[72] Second, "the option value that accrues due to the ability to dynamically assign capacity depending on shifting demand can increase super-linearly as the number of cooperating nodes in a network."[73] Yochai Benkler illustrates this when he states that the sharing of spectrum points toward the gain from network optionality by stressing the value of expanding "the set of usable combinations."[74] Property rights are inefficient in the dynamic allocation of spectrum, Benkler argues, because "[p]roperty rights in bandwidth inefficiently fence a sub-optimal resource boundary."[75]

Exhibit 1 locates these characteristics of anti-rivalry and inclusiveness as extensions of the existing dimensions. In the rivalry dimension, we start at private goods that exhibit high rivalry, which means that use by one subtracts from the use by another. We move to public goods, which exhibit low rivalry, where use by one does not subtract from use by the other. For anti-rivalry goods, we hypothesize the opposite effect, use by one adds to the potential for use by another. In the excludability dimension, we start with private goods, where it is easy to keeping people out. We move to public goods, where excludability is difficulty. For inclusive goods, we hypothesize to the opposite effect – the benefit of pulling people in.

Information goods are extremely good candidates to be collaborative goods because information is "an extreme nonrival good" and an "unusually" non-exclusive good.[76] A person can only own information if that person keeps the information to himself; once that information has been released to the public the person who distributed cannot control who else gains the information.[77]

Although information is hard to control, that alone does not guarantee collaboration. Collaborative

---

63 *Id.* at 973-74.
64 *Id.*
65 *Id.*
66 *Id.*
67 David P. Reed, *Comment for FCC Spectrum Policy Task Force on Spectrum Policy*, ET Docket No. 02-135, July 8, 2002, at 10.
68 *Id.*
69 *Id.*; Spectrum is a highly developed example analyzed in detail by Reed. He identifies how, as opposed to property rights that are to combat the "tragedy of the commons" by preserving property, "spectrum capacity increases with the number of users, and if proportional to N, each new user is self-supporting!" David P. Reed, *How Wireless Networks Scale: The Illusion Of Spectrum Scarcity*, Silicon Flatirons Telecommunications Program, Boulder Colorado (March 5, 2002).
70 Reed, *supra* note 67.
71 *Id.*
72 *Id.*
73 *Id.*
74 Yochai Benkler, *Open Spectrum Policy: Building the Commons in Physical Infrastructure*, 23, *available at* http://www.newamerica.net/Download_Docs/pdfs/Doc_File_122_1.pdf.
75 *Id.*
76 RISHAB AIYER GHOSH, WHY COLLABORATION IS IMPORTANT (AGAIN), IN CODE: COLLABORATIVE OWNERSHIP AND THE DIGITAL ECONOMY 1-2 (Rishab Aiyer Ghosh ed. 2005).
77 *Id.*

production is not successful just because of weak property rights; there must also be benefits to those that participate.[78] Collaborative production must increase value to the group. Collaborative production must motivate individuals to participate voluntarily as the individuals capture non-rivalrous benefits. It must allow free revealers to recognize that the potential gains of opportunistic behavior will evaporate if the cooperative behavior breaks down. Cooperation becomes the rule, rather than the exception.

The challenges to collaborative goods are also greatly different from those of public goods. In the world of private goods, the problem is the inclination to free ride, to withhold payment or support for the provision of public goods, or to overuse the common pool resource, even though that may be bad for the public. In the world of collaborative goods, the challenge is to understand the willingness of producers to support or freely reveal innovations that enhance shared benefits, even though they do not appear to capture as much private value as they could by withholding.

II. SOURCES OF ECONOMIC ADVANTAGE FOR COLLABORATIVE PRODUCTION IN THE DIGITAL AGE

A. Technological Conditions

In order for anti-rivalry and inclusiveness to dominate, communications and information must be available; for example, the areas examined in this paper have been deeply affected and benefited mightily from the revolution in computer and communications capacity. Of equal importance are the principles that organize interconnected computers into powerful networks; for example, distributed computer capacity able to communicate at high speeds and low cost is a platform that allows more readily for collaborative production.[79]

Historically, dramatic changes in communications and transportation technology have affected society deeply.[80] However, the convergence of a highly interrelated set of activities in the communications, computer, and information industries in the late twentieth century created not merely a new environment in which information is produced and distributed, but also a revolutionary change in a wide range of economic activities.[81] The digital communications platform "links the logic of numbers to the expressive power and authority of words and images. Internet technology offers new forms for social and economic enterprise, new versatility for business relationships and partnerships, and a new scope and efficiency for markets."[82]

Because society can distribute computing intelligence widely and quickly, society has transformed interactivity.[83] "As rapid advances in computation lower the cost of information production and as the cost of communications decline, human capital becomes the salient economic good involved in information production."[84] Users become producers as their feedback rapidly influences the evolution of information products. Society has also been transformed as the ability to embody knowledge in tools and software

---

[78] OSTROM, GARDNER & WALKER, *supra* note 45, at 220.
[79] M. CASTELLS, THE INTERNET GALAXY – REFLECTIONS ON THE INTERNET, BUSINESS, AND SOCIETY 28 (2001).
[80] FRANCES CAIRNCROSS, THE DEATH OF DISTANCE (2001).
[81] We can track the technological transformation across all dimensions of society [M. Cooper, *Inequality In Digital Society: Why The Digital Divide Deserves All The Attention It Gets*, 20 CARDOZO ARTS & ENT. L. J. 73, 93 (2002)], including the economy [BRIE-IGCC E-CONOMY PROJECT, TRACKING A TRANSFORMATION: E-COMMERCE AND THE TERMS OF COMPETITION IN INDUSTRIES (2001)], the workforce [I. H. Simpson, *Historical Patterns Of Workplace Organization: From Mechanical To Electronic Control And Beyond*, CURRENT SOCIOLOGY, 47 (1999); *see also* B. BLUESTONE & B. HARRISON, GROWING PROSPERITY: THE BATTLE FOR GROWTH WITH EQUITY IN THE TWENTY-FIRST CENTURY (2001)], the polity [E. C. KAMARCK & J. S. NYE JR. EDS., GOVERNANCE.COM: DEMOCRACY IN THE INFORMATION AGE (2002)], and civic institutions [A.L. SHAPIRO, THE CONTROL REVOLUTION: HOW THE INTERNET IS PUTTING INDIVIDUALS IN CHARGE AND CHANGING THE WORLD WE KNOW (1999)].
[82] ERIK BRYNJOLFSSON & BRIAN KAHIN, UNDERSTANDING THE DIGITAL ECONOMY: DATA, TOOLS AND RESEARCH 1 (Erik Brynjolfsson & Brian Kahin eds. 2000).
[83] CASTELLS, *supra* note 79.
[84] Y. Benkler, *Coase's Penguin, Or Linux And The Nature Of The Firm*, 2 (2001), *available at* http://www.law.duke.edu/pd/papers/Coase's_Penguin.pdf.

lowers the cost of transfer dramatically.[85]

Recent analyses of technological innovation have also provided strong evidence that the digital communications platform transformed the very fabric of the innovation process.[86] The technological revolution altered the information environment to make distributed solutions more feasible by fostering the uniquely user-focused character of the communications-intensive Internet solution. Technological advance is also making user-based design an attractive option.[87] It allows individuals to participate in task portioning and decision-making.[88]

The very technologies at the core of this revolution reinforce the dynamic of this change because they are platforms within networks. "A platform is a common arrangement of components and activities, usually unified by a set of technical standards and procedural norms around which users organize their activities. Platforms have a known interface with respect to particular technologies and are usually 'open' in some sense."[89] They are important because there are strong complementarities between the layers and each layer sustains broad economic activity in the layer above it.[90]

Communications and computer industries have always exhibited network effects and strong economies of scale.[91] Digitization reinforces these economic characteristics because economies of scope reinforce economies of scale. The embedded architecture of the network is at least as important as the technological characteristics. The technologies themselves would not be as powerful nor would the effect on the rest of society be as great if the platform had not evolved as an "ultrarobust" network.

B. Economic Advantages

In the digital environment, as described in Exhibit 2, there are three economic advantages created by collaborative production: 1) a higher level of sharing resources lowers the transformation costs of production; 2) transforming consumers into producers reduces the gap between consumers and producers; and 3) there is a greater value on the demand-side as participants facilitate and tap the energy of groups forming networks.

1. Supply-Side Transformation Resource Savings

The advantage in the transformation process rests on two factors. First, each set of activities accomplishes greater coordination by applying a combination of technological and human coordination.[92] For instance, mesh wireless communications rely more on embedding cooperation in the technology: the algorithms and protocols of communications devices. Open source, in contrast, relies more on human cooperation, greatly enhanced by digital communications. Peer-to-peer networks made up of non-technologists stand between the two. Technology does much of the work, but the functioning of the network requires the cooperation of the people using it. Most importantly, these networks survive with varying levels of human

---

[85] "Advances in scientific understanding decrease the costs of articulating tacit and context-dependent knowledge and reduce the costs of technology transfer. Further, such knowledge can be embodied in tools, particularly software tools, which make the knowledge available to others cheaply and in a useful form." ASHISH. ARORA ET AL., MARKETS FOR TECHNOLOGY: THE ECONOMICS OF INNOVATION AND CORPORATE STRATEGY 112, 113 (2001).
[86] This is also called "the changing technology of technical change." *Id.* at 112.
[87] Eric von Hippel, *Economics Of Product Development By Users: The Impact Of 'Sticky' Local Information*, 44 MGMT. SCI. 629, 642 (1998).
[88] ARORA ET AL., *supra* note 85.
[89] Shane Greenstein, *The Evolving Structure of the Internet Market*, *in* UNDERSTANDING THE DIGITAL ECONOMY, *supra* note 82, at 155.
[90] *See* SHAPIRO & VARIAN, *supra* note 56, at 9-15.
[91] *Id.* at 22-23.
[92] *See* Section IV, *infra,* for a description.

cooperation and skill.

Exhibit 2: Sources of Comparative Advantage of Collaborative Production

ACTIVITY	SHARED RESOURCE	PROCESS	BENEFIT
SUPPLY SIDE TRANSFORMATION RESOURCE SAVINGS			
Mesh Networks	Spectrum	Embedding Coordination in algorithms	Dynamic occupation of spectrum
Open Source software	Code	Embodied knowledge in software	Exploiting rich information in real time
Peer-to-Peer	Storage, Bandwidth, Content	Torrenting Viral communications	Reduction in cost and expansion of throughput Broad exchange, Collaboration
TRANSACTION COST REDUCTION			
All	Local knowledge	Consumer as Producer	Fit between consumer needs and output
DEMAND-SIDE VALUE CREATION			
All	Network	Self-organizing	Increased option value

Second, in each case, networks share critical resources: spectrum, code, storage, and bandwidth.[93] Sharing requires a process, a principle of cooperation that organizes the critical factors of production. The sharing of resources creates significant efficiencies for the networked activities and confers benefits to the collaborating parties. The capacity of the network expands. When the benefits are larger, the cost is lower. When it is easy to communicate, collaboration is more likely.

2. Transaction Cost Reductions

Collaborative production also produces an economic advantage because it transforms consumers into producers.[94] Reducing or removing the distinction between user and producer results in substantial transaction cost savings. The distance shortens between what producers produce and what consumers consume because the consumer turned producer knows what he wants more than a producer who is not a consumer. The consumer's and producer's interests are identical as they are the same person.

Users know what they need and want. Transferring that knowledge to producers creates inefficiency. Producers who are also users and volunteer for tasks that interest them inherently understand the production problem more clearly and can produce for their needs more easily instead of for the masses.

---

93 *Id.*
94 *Id.*

They have the locally specific knowledge necessary to solve problems.[95] There is also an agency problem when consumers are not producers.[96] When producers are separate from consumers, the producer may not be able to meet the needs of individual consumers precisely. However, when the developer is also the consumer, he will act in his own best interest when producing a product.[97]

3. Demand-Side Value Creation

Collaborative production creates economic advantage on the demand-side due to group formation.[98] This is the demand-side since the size of the network, the number of network members that are reachable, and the pattern of interactions dictate the value of the network to the members. As the value of the network increases, the possibilities for communications (and therefore commerce) also increase. As consumers decide which group, and therefore network, to join they also change the group to fit their needs. This increases the value of the group to the consumer even more.

Reed identifies three types of networks that create value (see Exhibit 3).[99] First, there are one-way broadcast networks.[100] Also known as the Sarnoff "push" network, the value of one-way broadcast networks is equal to the number of receivers that a single transmitter can reach. [101] An example of a one-way broadcast network is the wire service.[102] Second, there are Metcalfe networks.[103] In a Metcalfe network, the center acts as an intermediary, linking nodes.[104] Classified advertising is an example of the Metcalfe network.[105] Third, there are Group Forming Networks, also known as Reed Communities.[106] In this network, collateral communications can take place.[107] The nodes can communicate with one another simultaneously.[108] Chat groups are the classic example of this type of network.[109]

Collateral communications expands the possible connections dramatically. Network optionality, when realized in group-formation, generates much greater value than traditional models. As more people join the network, the value of the network increases.[110] In addition, networks that "support the construction of communicating groups create value that scales *exponentially* with network size, i.e. much more rapidly than Metcalfe's square law… [called] Group Forming Networks."[111]

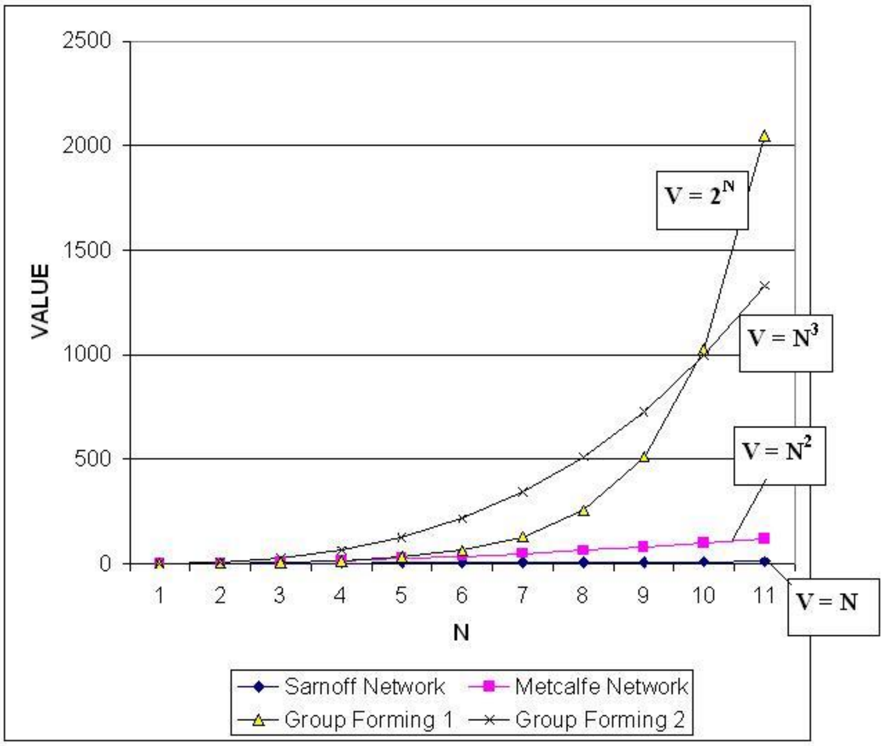
Exhibit 3 shows how the value of being part of the network scales as the number of members increases. The Sarnoff value is N. The Metcalfe value is N^2. The Reed community value is 2^N. The key difference between the Metcalfe network and the Group Forming Network is multi-way communications. Group Forming Networks use group tools and technologies such as chat rooms and buddy-lists that "allow small or large groups of network users to coalesce and to organize their communications around a common interest, issue, or goal."[112] The exponentiation increases value very quickly and may cause the number of

---

[95] ERIC VON HIPPEL, OPEN SOURCE SOFTWARE PROJECTS AS USER INNOVATION NETWORKS (2002); PERSPECTIVES ON FREE AND OPEN SOURCE SOFTWARE 271 (Joseph Feller et al. eds. 2005).
[96] *Id.* at 277.
[97] VON HIPPEL, *supra* note 57, at 276-77.
[98] Section IV, *infra*, describes the value of group formation in each of the three areas studied in this paper.
[99] *See* David P. Reed, *That Sneaky Exponential – Beyond Metcalfe's Law to the Power of Community Building* (Spring 1999), *available at* http://www.reed.com/Papers/GFN/reedslaw.html.
[100] *Id.*
[101] *Id.*
[102] *Id.*
[103] *Id.*
[104] *Id.*
[105] *Id.*
[106] *Id.*
[107] *Id.*
[108] *Id.*
[109] *Id.*
[110] *Id.*
[111] *Id.*
[112] *Id.*

connections/communications to exceed the ability of individuals to maintain them. Thus, it is a theoretical upper limit. On the other hand, as Reed points out, the formation of even a small subset of the theoretically possible groups would dramatically increase the value of the network - N^3 in Exhibit 3. Even if not all groups form, the potential value in the option to form groups is higher. The critical point is that to capture the value of group forming networks, the members of the network must have the freedom to self-organize groups. With that freedom, they create the groups of greatest value to the users.

Exhibit 3: Value of Traditional and Group Forming Networks



Source: David Reed, "That Sneaky Exponential – Beyond Metcalfe's Law to the Power of Community Building," *Context,* Spring 1999

C. Cooperation In A New Age Of Collective Action

Since cooperation lies at the core of the emerging mode of production, it is important to understand why a new solution to the challenge emerges. Conventional collective action arguments say that a large group is less likely to generate collective goods because each member would receive such a small fraction of the benefit that they would lose their desire to produce collectively. [113] However, with the emerging collaborative production the opposite is true as seen in open-source software: the larger the group connected by the Internet, the more likely it is to have the motivation and resources to create code.[114] User-driven

[113] WEBER, *supra* note 5, at 155.
[114] *Id.*

innovation causes individuals to volunteer, particularly the core group of lead users.[115]

The existence of heterogeneous resources available in the network definitely improves the efficiency of collaborative responses, but this may not be a necessary condition. The critical condition is the ease of communications. The Internet, for instance, spawned innovation, as participants of group projects were able to work together over long distances and share their specific skills in a "seamless process."[116]

New communication technologies allow for reduction in cost of sending information long distances, increase "noticeability, and make ineffective communicative networks effective."[117] Communications technology allows large numbers of people with common interests to interact and share information "in a way that undermines many widely held beliefs about the logic of collective action."[118]

It may well be that the literature on collective action was always too pessimistic.[119] For example, the literature that stresses the tragedy of the commons assumes "individuals do not know one another, cannot communicate effectively, and thus cannot develop agreements, norms, and sanctions" was never correct in physical space and certainly is not correct in cyberspace.[120] The ability to communicate changes everything – especially when a collective payoff flows from cooperation.

In addition, the recognition of shared interest plays a key role in establishing the necessary cooperation. When a monitored and sanctioned system is agreed upon, it "enhances the likelihood that agreements will be sustained, they are capable of setting up and operating their own enforcement mechanism."[121] Due to the benefits received from cooperation, the effect of breaking those agreements may deter those inclined to break the agreements, as it will affect not only the individual, but also the group as a whole.[122] Thus, even prior to the advent of digital communications platforms, the ability to communicate and exchange information was central to the ability to organize around shared interests and take collective action, but the capacity to do so has been fundamentally enhanced by the recent technological revolution.

III. INTERNAL ORGANIZATION OF DIGITAL PRODUCTION

A. Supply-side Resource Savings

1. Open Mesh Networks

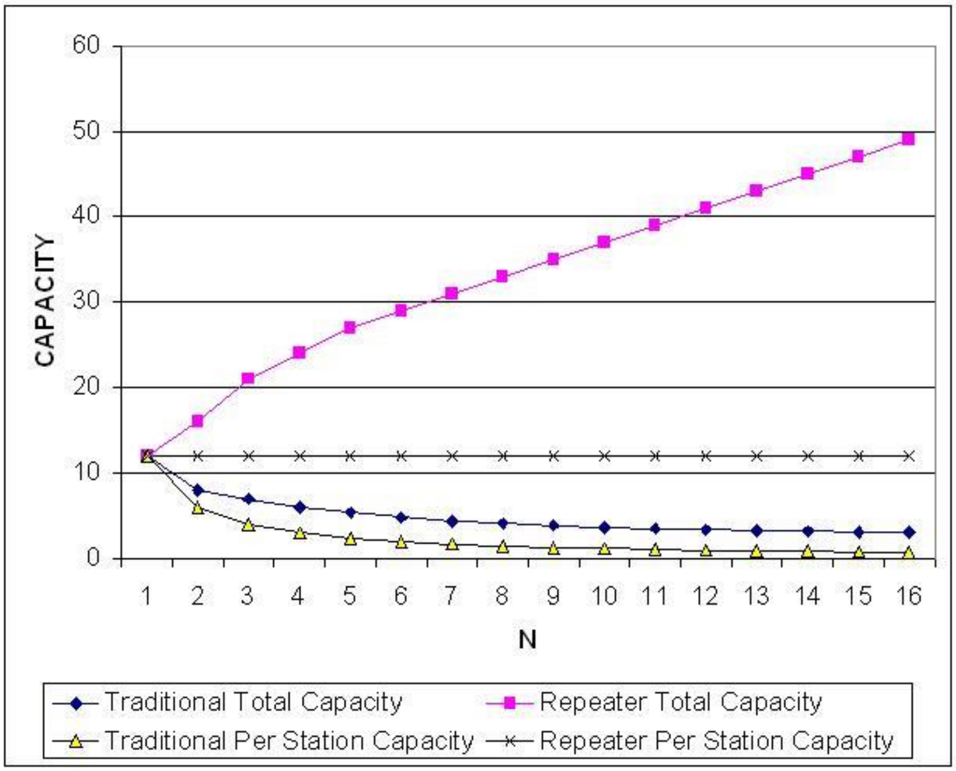
Mesh networks in the spectrum commons exhibit the advantages of collaborative production on the supply side.[123] As people add devices, the total capacity of the system increases due to those devices routing communications throughout the network (see Exhibit 4).[124] Depending on how well these devices share the network traffic, the capacity of each device may decline, but at a slower rate than if they did not share communications.[125] If the graph showed a cost curve, it would show that the cost per unit of capacity is lower for both total capacity and on a per station basis in the repeater network.[126]

---

[115] *See generally* VON HIPPEL, *supra* note 57.
[116] WEBER, *supra* note 5, at 83-84.
[117] Lupia & Sin, *supra* note 12, at 329.
[118] *Id.*
[119] *See generally* OSTROM ET AL., *supra* note 45, at 319.
[120] *Id.*
[121] *Id.* at 220.
[122] *Id.* at 296.
[123] Reed, *supra* note 69.
[124] *Id.*
[125] *Id.*
[126] *Id.*

The technologies at the heart of the digital revolution are also at the heart of the deployment of open wireless networks in the spectrum commons. The potential spectrum carrying capacity has been the direct beneficiary of the convergence of progress in digital technology and the institutional development of networks.[127] When users add radios that help by cooperating in receiving and forwarding signals, i.e. act as repeaters, carrying capacity of the network increases.[128] Smart nodes get their expanding brainpower from decentralized computational capacity to communicate seamlessly, utilizing embedded coordination protocols.[129]

Exhibit 4: Spectrum Capacity In Traditional And Repeater Networks



Source: D. P. Reed, "How Wireless Networks Scale: The Illusion of Spectrum Scarcity," Silicon Flatirons Telecommunications Program, March 5, 2002, pp. 10, 14.

Smart technologies in mesh networks cooperating to deliver messages also show the beginning of anti-rivalry characteristics.[130] The ability of each node to receive and transmit messages, even when they are neither the origin nor the destination, expands the capacity of the network. This intelligence is the key to mesh networks' immense capacity.[131]

---

[127] "There is a 'new frontier' being opened up by the interaction of digital communications technology, internetworking architectures, and distributed, inexpensive general purpose computing devices." Reed, *supra* note 67, at 2.
[128] R. J. BERGER, *No Time for a Big Bang: Too Early to Permanently Allocate Spectrum to Private Property*, CENTER FOR GLOBAL COMMUNICATIONS 7 (2003).
[129] Reed, *supra* note 67.
[130] Reed, *supra* note 69.
[131] L. Berlemann, S. Mangold & B.H. Walke, *Policy-based Reasoning for Spectrum Sharing in Cognitive Radio Networks*, IEEE

The spectrum commons in which these networks exist exhibits the characteristic of inclusiveness, since the more nodes on the network, the greater the value to users.[132] The denser the nodes in the commons, the greater is the commons' communications capacity.[133] The combination of digital technology and network organization has turned the old logic on its head; adding users on a mesh network improves performance.[134] Mesh networks allow devices to share their resources dynamically, allowing more communications to take place with less power.[135]

However, even with new technology, there is still the challenge of how to ensure cooperation among users. Since cooperation is the key to the capacity gain, if users chose not to cooperate, the mesh network will not work.[136] Therefore, more devices are transitioning to "embed coordination" to ensure cooperation.[137] For example, radios become smart by embedding intelligence – algorithms – that take on the functions necessary to transmit a signal after listening to the spectrum and finding available frequencies to use and determining the power necessary.[138]

2. Open Source

The digital environment is particularly challenging for the production of goods used to produce other goods and services, called functional information goods, such as software. This is due in part to people not consuming functional goods for their intrinsic value, like viewing a movie, but to meet other needs, like writing a document with word processing software. Because software is a tool that will be used by different people in different ways under different circumstances, it is more difficult to design and build than cultural goods.[139]

Just as mesh networks defy the conventional wisdom of collaboration, so does open source. "[T]he sharing of rich information in real time" deeply affects the basis for collective action "because (a) constituents have symmetry of absorptive capacity, and (b) software itself is a capital structure embodying knowledge."[140] The capacity of groups to produce open source software increases due to the sharing and exchange of information between humans much as occurs between devices in mesh networks: collaboration increases capacity and lowers cost (see Exhibit 5).[141]

The increase in low cost communications and distributed computer intelligence has a particularly powerful impact on the ability to produce information products where users are technically savvy.[142] With a vast array of diverse individuals available to address the complex problems of producing software, the human resource pool is expanded. By drawing from this pool, there is an increase of the chances that someone, somewhere will have the necessary skills to solve a problem. By keeping systems open and

---

Int'l Symp. on New Frontiers in Dynamic Spectrum Access Networks (Nov. 8-11, 2005).

[132] *See* Reed, *supra* note 99.

[133] Reed, *supra* note 67.

[134] *Id*.

[135] Reed, *supra* note 69.

[136] T. X. Brown, *An Analysis of Unlicensed Device Operation in Licensed Broadcast Service Bands,* IEEE Int'l Symp. on New Frontiers in Dynamic Spectrum Access Networks (Nov. 8-11, 2005) (noting the superior characteristics where participation is broad); Lehr and Crowcroft, *Managing Shared Access to a Spectrum Commons*, IEEE Int'l Symp. on New Frontiers in Dynamic Spectrum Access Networks (Nov. 8-11, 2005) (emphasizing the importance of requiring participation).

[137] Berleman, *supra* note 131.

[138] Reed, *supra* note 67.

[139] Srdjan Rusovan, Mark Lawford & David Lorge Parnas, *Open Source Software Development: Future or Fad?, in* PERSPECTIVES ON FREE AND OPEN SOURCE SOFTWARE, *supra* note 95 (describing the complexity problem facing software); s*ee also* WEBER, *supra* note 5, at 61-62.

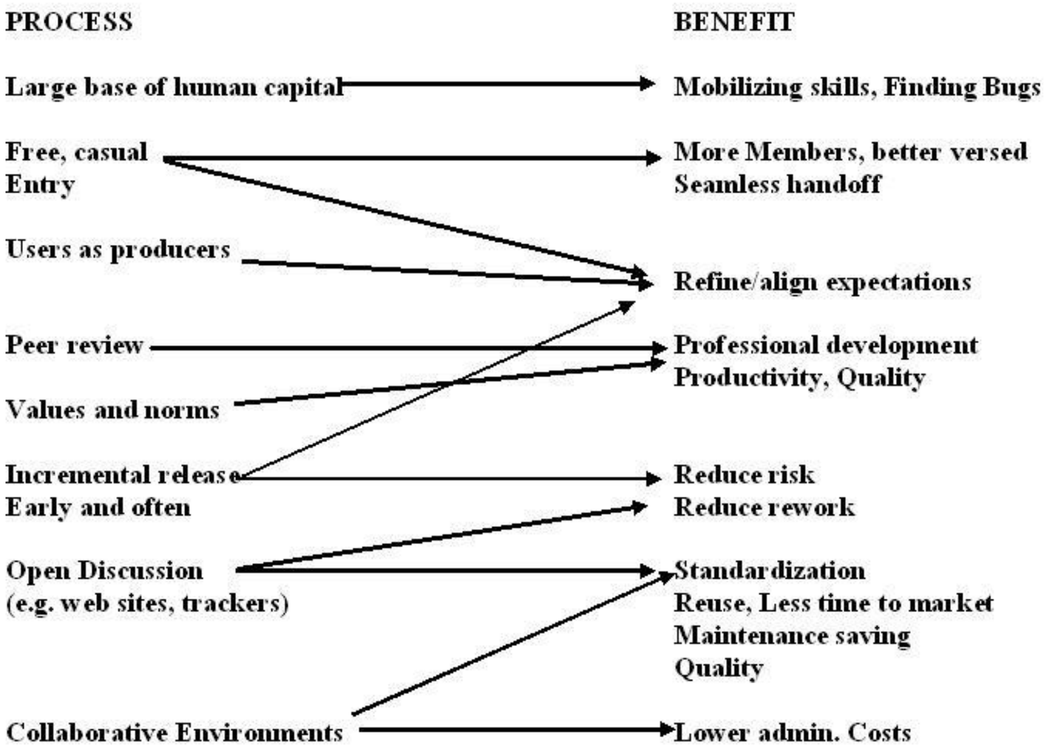
[140] Giampaolo Garzarelli, *Open Source Software and the Economics of Organization*, ii (April 30, 2002), *available at* http://opensource.mit.edu/papers/garzarelli.pdf.

[141] WEBER, *supra* note 5, at 81.

[142] Josh Lerner & Jean Tirole, *Some Simple Economics of Open Source,* 50 J. OF INDUS. ECON. 197, 202 (2002) (describing "the third era" of open source as "the widespread diffusion of Internet access early in the 1990s led to a dramatic acceleration of open sources activities.").

promoting interoperability, the chances increase that the project will have a solution to any problems encountered. While the decentralized approach encourages multiple attempts to solve a problem, there is also the advantage of quickly communicating solutions so that everyone can move to the next problem after a solution is found.[143]

Exhibit 5: Benefits of Open Source



3. Peer-to-Peer Networks

As hardware and communications costs declined and larger, faster PC's penetrated the market and larger, video files began to move over broadband connections, both the central servers and backbone capacity of the Internet quickly became economic bottlenecks.[144] The evolving infrastructure of the Internet made it inevitable that users would eventually develop software to escape this bottleneck by tapping into the abundant resources available on the network's edges.[145] By building a multi-level redundancy and additional communication points into the network, the network becomes more robust and scalable.[146]

Peer-to-peer networks are part of the evolving communications infrastructure.[147] The immense

---

143 JOSEPH FELLER & BRIAN FITZGERALD, UNDERSTANDING OPEN SOURCE SOFTWARE DEVELOPMENT 86 (2002).
144 *See* Brief of American Civil Liberties Union as Amicus Curiae Supporting Respondents, at 12-13, MGM Studios Inc. v. Grokster Ltd., 125 S. Ct. 2764 (2005) (No. 04-480) (noting the volume of material moving).
145 *See* Brief of Computer Science Professors Harold Abelson et al., at 10, MGM Studios Inc. v. Grokster Ltd., 125 S. Ct. 2764 (2005) (No. 04-480); Brief of Creative Commons, at 11, MGM Studios Inc. v. Grokster Ltd., 125 S. Ct. 2764 (2005) (No. 04-480) (on sharing of capacity at the edges).
146 DUNCAN J. WATTS, SIX DEGREES (2003) (identifying the superiority of multiscale, ultrarobust networks); *see generally* Cooper, *supra* note 52, at 117-26 (describing the structure of the Internet).
147 *See* Brief of Sixty Intellectual Prop. & Tech. L. Professors et al., at 28, MGM Studios Inc. v. Grokster Ltd., 125 S. Ct. 2764 (2005) (No. 04-480).

carrying capacity of current peer-to-peer networks exists precisely because those networks are decentralized.[148] The value of decentralized communicating nodes is realized when the nodes directly communicate with one another as they allow peer-to-peer networks to be efficient, robust, and scalable.[149] This open architecture allows for efficient solutions when there are scarce resources by exploiting resources that are more abundant.[150] Peer-to-peer network spread the distribution costs among millions of computers giving "content owners far more flexibility in making their works available to the public" and spawning "new business applications that utilize distributed computing technology."[151]

While open source software is the collaboration of a few highly skilled individuals working together, peer-to-peer networks represent a broader phenomenon. They draw in both technical and non-technical participants because of the widespread deployment of devices and software capable of simple deployment of peer-to-peer networks allowing non-technical people an easy way to join peer-to-peer networks.[152] As with open source software, people must be willing to participate, but the level of engagement is much more variable and potentially lower in peer-to-peer networks. However, the level of engagement varies. On the passive end of engagement are peer-to-peer file sharing networks. These networks only require that participants put up and take down files. At the other extreme, very active collaboration is possible. Wikis require that participants co-produce a document by sequentially editing and or commenting on an emerging product.[153]

B. Transaction Cost Reductions

1. Open Mesh Networks

As technology advances, smart technologies will allow for more transmissions in open mesh network due to changes in the frequency, timing, and spacing of transmissions.[154] Due to the way the network is organized, when transmitters leave the network, the work they were doing can be taken over by other transmitters regardless of whether the transmitters are repeaters or not.[155] Seamlessness is essentially already built into devices, as it is a matter of technical protocol.[156] As carrying capacity is developed, the full set of physical transactions must take place in all cases for the open mesh networks to become dynamic environments. The embedding of coordination protocols in a commons approach avoids the costs and challenges of negotiating, clearing, billing, and enforcing rights that will make transactions more costly.[157]

A traditional analysis of such a common-pool resource would focus on the allocation costs, external benefits of different rules, and transaction costs. However, as open mesh networks are non-depletable, the only relevant allocation cost is the congestion cost. Unlike traditional common-pool resources, when dealing with open mesh networks, any rules urging a restriction of capacity should be suspect and any promoting increases in capacity should be preferred. As discussed above, because open mesh networks are dynamic,

---

[148] *See* Albelson, *supra* note 145; Brief of Creative Commons, *supra* note 145.
[149] *See* Albelson, *supra* note 145, at 10-11.
[150] *See* Creative Commons, *supra* note 145.
[151] Brief of Distributed Computing Indus. Ass'n, at 15, MGM Studios Inc. v. Grokster Ltd., 125 S. Ct. 2764 (2005) (No. 04-480).
[152] LEE RAINEE & MARY MADDEN, THE STATE OF MUSIC DOWNLOADING AND FILE SHARING ONLINE, PEW INTERNET AND AMERICAN LIFE PROJECT 2 (2004) (estimating 34 million KaZaa Media Desktop File Sharing Applications actively running in June of 2003); Lerner & Tirole, *supra* note 142, at 204 (estimating, "Computer system administrators, database administrations, computer programmer, and other computer scientists and engineers represent about 2.1 million jobs in the united states.").
[153] However, it is interesting to note that it is the activities that require little participation that are getting the most attention, especially as far as legal attention such as with file sharing.
[154] Arnon Tonmukayal & Martin B.H. Weiss, *An Agent-Based Model for Secondary Use of Radio Spectrum*, IEEE Int'l Symp. on New Frontiers in Dynamic Spectrum Access Networks (Nov. 8-11, 2005).
[155] Brown, *supra* note 136.
[156] J. Giacomoni & D.C. Sicker, *Difficulties in Providing Certification and Assurance for Software Defined Radios,* IEEE Int'l Symp. on New Frontiers in Dynamic Spectrum Access Networks (Nov. 8-11, 2005).
[157] Berger, *supra* note 128, at 4.

the transaction costs associated with negotiating clearance rights to transmit are high.[158] This challenge will become even greater as more transmitters and receivers become mobile. Solving the transaction problem at the physical level and avoiding haggling is over rights is the most attractive solution.[159]

2. Open Source

At the institutional level of open source projects, there is a large base of contributors because entry into open source development is easy, free, and casual,[160] which allows open source participants to tackle complex and diverse projects.[161] Many of the programmers of open source are also the users of the products. At the individual level, there are a large number of motivations for participating in open source development[162] and open source projects allow for self-selection of tasks.

Two aspects of open source help reduce transaction costs. First, the demand-side advantage to open source is that programmers are also consumers.[163] This increases the value of the product and the "willingness to pay" in a non-commodified sense of contributing time and effort to the collaborative.[164] Second, the agency costs of separating users from producers discussed in the case of open source are, of course, transaction costs.[165] In open source, the technical skills of the programmer community play an important role.[166] von Hippel underscores the potentially revolutionary development that flows from the transformation of users into producers because users can "build, consume, and support innovations on their own, independent of manufacturer incentives" and allows for a "diffusion of innovation by and for users… to get what they really want."[167]

3. Peer-to-Peer Networks

When looking at the transaction cost advantages of peer-to-peer networks, the production and distribution of music continue to be the focal point.[168] The costs involved with searching for music decreases and the information quality received improves.[169] This, in turn, reduces the total costs and increases demand for music.[170] In addition, especially important for the artists, peer-to-peer networks change how music is produced and distributed[171]

Distribution of recorded music over the Internet decreases the costs of producing, manufacturing, and distributing music because there is no longer a cumbersome centralized distribution system.[172] Peer-

---

[158] Benkler, *supra* note 74.
[159] N. Ikeda, *The Spectrum as Commons: Digital Wireless Technologies and the Radio Policy*, Research Institute of Economy, Trade and Industry, at 10 (2002).
[160] Lerner & Tirole, *supra* note 142 (noting the dramatic increase in participation in open source projects in the 1990s); WEBER, *supra* note 5, at 65-72 (describing the wide range of participation in projects).
[161] WEBER, *supra* note 5, at 59-65 (discussing "distributed" work).
[162] Karim R. Lakhani & Robert G. Wolf, *Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open source Software Projects*, *in* PERSPECTIVES ON FREE AND OPEN SOURCE SOFTWARE, *supra* note 95; Rishab Aiyer Ghosh, *Understanding Free Software Developers: Findings from the FLOSS study*, *in* PERSPECTIVES ON FREE AND OPEN SOURCE SOFTWARE, *supra* note 95.
[163] VON HIPPEL, *supra* note 95.
[164] WEBER, *supra* note 5, at 74 (emphasizing the importance to programs of participation to solve a problem that concerns them in the suggestion that programmers "scratch and itch.").
[165] VON HIPPEL, *supra* note 95, at 276.
[166] *Id.*
[167] *Id.*
[168] WILLIAM W. FISHER, III, PROMISES TO KEEP 18-31 (2004).
[169] Brendan M. Cunningham, Peter Alexander & Nodir Adilov, *Peer-to-Peer Sharing Communities,* INFORMATION ECONOMICS AND POLICY, 16 (2004).
[170] FISHER, *supra* note 168, at Appendix.
[171] *See* Mark N.Cooper, *Time for the Recording Industry to Fact the Music: The Political, Social and Economic Benefits of Peer-to-Peer Communications Networks* (2005), *available at* http://cyberlaw.stanford.edu/blogs/cooper/archives/BENEFITSofPEERtoPEER.pdf.
[172] FISHER, *supra* note 168, 260, app. tbl.A.1 (2004); DERECK SLATER ET AL., BERKMAN CTR. FOR INTERNET AND SOC'Y, HARVARD LAW SCHOOL, CONTENT AND CONTROL: ASSESSING THE IMPACT OF POLICY CHOICE ON POTENTIAL ONLINE BUSINESS MODELS IN THE MUSIC

to-peer networks further reduce costs by lowering record company overhead and marketing, which currently account for approximately a quarter of the cost of music.[173] This eliminates up to three-quarters of the costs; one author notes that while the average price per CD in 2001 was about $17.99, the production cost was about fifty cents and the artists only received about twelve cents.[174] While some say artists receive more, even those authors do not place the amount much higher than a dollar, net of costs.[175] Thus, the costs of music decrease dramatically by reducing, or even eliminating, the role of intermediaries. Distribution of music over peer-to-peer networks allows this decrease as producers of goods and services find new ways to deal directly with consumers. In addition, consumers also are able to establish relations with one another, or to become producers in their own right

C. The Demand-Side Value Enhancement

1. Open Mesh Networks

Although the benefit of open wireless networks lies primarily on the supply-side, there are benefits to the demand-side. In order to capture the full benefits of a spectrum commons, people must form ad hoc mesh networks.[176] To appreciate this, we must understand the devices used in and the creation of ad hoc mesh networks (see Exhibit 6).[177]

Devices used for open wireless networks will need to detect use of the spectrum, assess the quality of service it needs for its own transmission, and ascertain whether transmitting in the space available and in the necessary manner can be done without interfering with other devices.[178] These devices become cognitive as they "identify, remember, update, share opportunity information, and exploit the opportunity information with adapted transmission to avoid causing harmful interference."[179] Exhibit 6 illustrates this concept starting on the bottom left and working to the top right: each of the concepts subsumes construction of the one below as a complex network.

To make a cognitive device, one starts with the basic building block of the network: a device that uses software, as opposed to hardware, to change its frequencies, power, and modulation.[180] When one adds sensors and a reasoning system to the device, the device becomes cognitive and aware of the rules of the network.[181] Embedded logic systems allow them to decide when to transmit without breaking the law adding intelligence to the network.[182] Mesh wireless networks then integrate these devices as access points and relay nodes (repeaters) used to support any communication meant for any destination.[183]

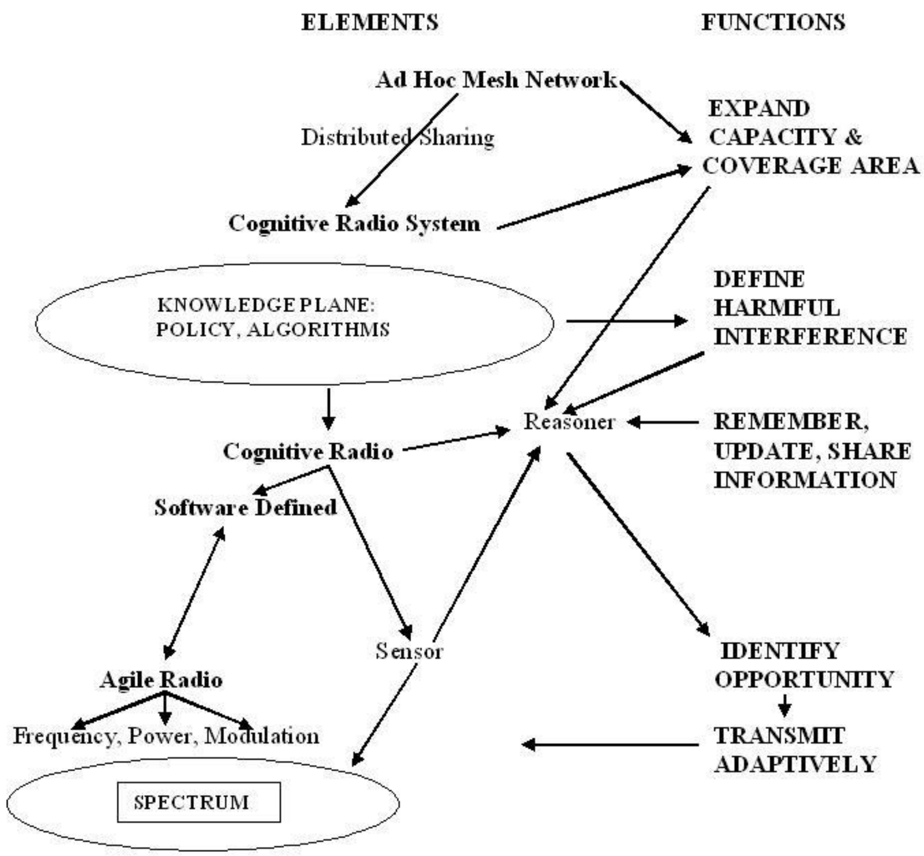
The group forming value emerges as ad hoc network allow radios to join and leave the network. Therefore, they adapt as necessary, since the "connections are transient and formed in an ad hoc as-needed basis" allowing for the development of a "self-healing networking in which routing continues in the face of broken nodes or connections."[184] Unlike the networks that existed in the spectrum during the twentieth

---

AND FILM INDUSTRIES AV-I (2005), *available at* http://cyber.law.harvard.edu/media/files/content_control.pdf.
[173] *Id.*
[174] Bill Wittur, *Selling Minor Chords in Exchange for a Happy Tune*, MUSIC DISH, (Dec. 12, 2004) *available at* http://musicdish.com/mag/index.php3?id=4859.
[175] FISHER, *supra* note 168, at 260, app. tbl.A.1.
[176] Giacomoni, *supra* note 156.
[177] Berleman et al., *supra* note 131.
[178] *Id.* at 4.
[179] Robert J. Degroot et al., *A Cognitive-Enabled Experimental System*, IEEE Int'l Symp. on New Frontiers in Dynamic Spectrum Access Networks (Nov. 8-11, 2005).
[180] Berleman et al., *supra* note 131.
[181] *Id.*
[182] *Id.*
[183] *Id.* at 4-8.
[184] Giacomoni, *supra* note 156.

century, cognitive devices in ad hoc networks show the ability of human intelligence to build incredibly complex, replicable networks that embed coordination. At the core of the network is the reasoner – "a software process that uses a logical system to infer formal conclusions from logical assertions."[185] It works by "inferring statements from other statements… represented in a machine understandable way… that allows not only first-order logics, but also higher-order, class-based reasoning."[186]

Exhibit 6: Mesh Network Elements and Functions



2. Open Source

The demand-side values are enhanced with open source because at the core of its success is peer-review at both the institutional and individual levels. Individually, peer review among programmers promotes professional development and motivates participation.[187] Institutionally, peer review promotes quality by vetting output across a large audience. The reliance on open communication through mail lists, websites, Wikis, and collaborative tools helps create an environment inductive to peer review.[188]

---

185 Berleman et al., *supra* note 131.
186 *Id.*
187 FELLER & FITZGERALD, *supra* note 143, at 88.
188 WEBER, *supra* note 5, at 81 (putting it simply, "Talk a lot.").

In addition, there is a clear set of group values and norms used to evaluate programs. Standardization and reuse are important.[189] Communication is important among all members of the community shown by project administrators making frequent releases and builds of programs available.[190] Social commitment – a broad category that includes altruism – and ideological motives, such as personal motivation to do a good job or a dislike of proprietary code, also come into play.[191]

3. Peer-to-Peer

The demand-side of peer-to-peer networks encourages three different forms of relationships between individuals: exchange, viral communications, and collaboration.[192] Peer-to-peer networks foster exchange between equals by the search capability of the network and the direct relationships between nodes. As the capacity for networks to communicate increases, peer-to-peer networks exhibit classic demand-side economies of scale. Viral communications and collaboration enhance the ability to market and expand the ability to innovate as shown with the new emerging relationship between artists and fans.[193] In addition, peer-to-peer collaboration can be anonymous, where individuals sequentially add to or modify a product,[194] and they can be interactive co-production.[195]

The demand-side is also changed because the relationship between artists and audiences changes. The hold of the recording companies weakens and their ability to make stars decreases, as "there is a greater probability of discovering other high quality music items by lesser known artists with the new technology."[196] The ability to sample "is an information-pull technology, a substitute to marketing and promotion, an information-push technology."[197] The cost structure of the industry changes as it adopts digital technologies. Performance improves, as "variable costs relative to fixed costs are more important for music downloads than for CDs."[198] The ability for lesser-known artists to succeed increases due to "a less skewed distribution of sales among artists."[199] In fact, we do observe this pattern. The payoff for artists and society is increasing diversity.[200] In addition, it creates the opportunity for the artists to gain more from "piracy" than the publishers as illegal recordings may create a larger demand for live performances as an artist's popularity increases.[201]

CONCLUSION

There is a twilight zone in economics between market failure and market success inhabited by public goods and externalities. Collaborative production, and the goods it creates, will play a key role in filling this zone and creating economic growth in the digital age. The location of these goods with respect to traditional economic analysis is clear. In the industrial economy of the 20th century, economic analysis grappled with goods that were non-rivalrous and non-excludable.[202] However, in the digital economy of the 21st century, computer and communications technologies expand the challenge of economic analysis.

---

[189] *Id.* at 75.
[190] *Id.* at 80.
[191] Lakhani & Wolf, *supra* note 162.
[192] Brief of Sovereign Artists, at 6-7, MGM Studios Inc. v. Grokster Ltd., 125 S. Ct. 2764 (2005) (No. 04-480).
[193] *See* Brief of Distributed Computing Indus. Ass'n, *supra* note 151, at 19.
[194] Brief of Sovereign Artists, *supra* note 192.
[195] *Id.* at 38.
[196] Ram. D. Gopal et al., *Do Artists Benefit from Online Music Sharing?*, 79 J. OF BUS. 1503, 1530 (2006).
[197] MARTIN PEITZ & PATRICK WAELBROCK, FILE-SHARING, SAMPLING, AND MUSIC DISTRIBUTION 5 (Int'l U. in Germany, Working Paper No. 26, 2004), *available at* http://ssrn.com/abstract=652743.
[198] Martin Peitz & Patrick Waelbroeck, An Economist's Guide to Digital Music 35 (CESifo Working Paper No. 1333, 2004), *available at* http://ideas.repec.org/p/ces/ceswps/_1333.html.
[199] *Id.*
[200] Gopal et al., *supra* note 196, at 1525-29.
[201] Amit Gayer & Oz Shy, *Publishers Artists and Corporate Enforcement,* INFO. ECON. & POL'Y (forthcoming 2006) (manuscript at 2-3, on file with author).
[202] TAYLOR, *supra* note 32; *see generally,* OSTROM, *supra* note 45.

Anti-rivalry and inclusiveness are critical economic conditions. The value of anti-rival and inclusive goods increases as more users participate freely in their production, consumption, and distribution.[203] By failing to implement policies that allow collaborative production to thrive in group-forming networks, society will suffer greatly.

To avoid this pitfall, it is necessary to understand the broad policy implications of choosing a mode of production. Developing specific policies in a number of areas will promote the efficient expansion of collaborative production. Broad policy goals must be developed with a clear understanding of what implications these goals will have for the telecommunication world.

A. Broad Policy Goals

Several characteristics of the collaborative mode of production give policymakers reasons to support it, including five economic and socio-political characteristics. First, there is accommodating uncertainty. Decentralized user driven focus has clear advantages in flexibility.[204] It is less dependent on small numbers of network owners guessing what the demands on the network will be. It avoids large lumpy investment. It helps to lower the cost of updating and versioning. Flexibility enhances the ability of the structure to accommodate uncertainty.

Second, there is innovation. The decentralized end-user driven innovation is likely to accommodate far more experimentation and innovation.[205] As I have shown, the experience of unlicensed spectrum in the age of digital technology shows that networked platforms exhibit the fundamental characteristic of user-driven innovation and aggressive atomistic competition because of its decentralized nature.

Third, there are incentives and infrastructure. Centralized networks give network operators an incentive and ability to exercise market power, to reduce or control communications to maximize private profits.[206] The social cost of the exercise of market power in communications networks grows because it retards the ability to achieve collaborative gains.[207] In collaborative production systems with embedded coordination, decentralized investment, and cooperation gain, this ability to abuse market power is reduced.[208]

Fourth, there is the democracy principle. Although this paper has focused on economic issues, there is no doubt that decentralized open networks have desirable political characteristics.[209] The licensing regime that protected broadcasters excluded people from projecting their voices, thus limiting their right to speak.[210] Because of the one-way broadcast nature of twentieth century electronic mass media, the First Amendment concentrated on the ability to hear diverse points of view, also known as listeners' rights.[211] Open wireless and peer-to-peer networks expand the ability to speak and help ensure First Amendment rights by returning them more closely to their original formulation.[212]

---

[203] *See* Section II, *supra*.
[204] W. Lehr, *The Economic Case for Dedicated Unlicensed Spectrum Below 3 GHz*, 8 (2004), *available at* http://itc.mit.edu/itel/docs/2004/wlehr_unlicensed_doc.pdf.
[205] *Id*.
[206] Reed, *supra* note 67.
[207] Lehr, *supra* note 204, at 16-23.
[208] Lehr, *supra* note 204 (arguing unlicensed spectrum provides a check on market power).
[209] *See* Yochai Benkler, *Free as the Air to Common Use: First Amendment Constraints on Enclosure of the Public Domain*, 74 N.Y.U. L. REV. 354 (1999); Yochai Benkler, *Property Commons and the First Amendment: Toward a Core Common Infrastructure* (White paper for the Brennan Center for Justice) (2001), *available at* http://www.benkler.org/WhitePaper.pdf.
[210] Mark Cooper, Spectrum and Speech in the 21st Century (2006), *transcript available at* http://cyberlaw.stanford.edu/blogs/cooper/archives/spectrum%20is%20speech.pdf.
[211] *Id*.
[212] LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE (1999).

Fifth, there is the idea of creativity. There is a socio-cultural benefit in the growth of collaborative production independent of the aspect of political expression.[213] The pleasure in creativity, attributed to the open source coder, is simply an example of the broader principle that self-expression through creative production is satisfying. Similarly, the desire to contribute without compensation is strong. People want to participate in the production of culture.

B. Communications Policy

This analysis has broad implications for many areas of public policy (see Exhibit 7). The key principle of expanding the flow of information from the ends of the network, the end-to-end principle, is the cornerstone of the value creation. The unimpeded flow of communications is the key to collaboration on the supply-side and group formation on the demand-side. Future allocative and adaptive efficiency will depend upon a pervasive computing environment in which the endpoints are mobile.

Open wireless networks in the spectrum commons are better able to support such activity. Massive mobile computing is the future; the Sarnoff broadcasting networks are the past. A progressively expanding swath of unlicensed spectrum should be the main policy. Unlicensed spectrum is not the exception; it should be the rule. If unlicensed space becomes congested, it is necessary to move licensed applications out of the way, especially in the lower frequencies.

Exhibit 7:

PRESERVE EXISTING USER RIGHTS

Preserve nondiscriminatory Interconnection and carriage (network neutrality) in communications networks

Protect fair use and fight to preserve routine, unregulated uses.

REFORM THE CURRENT SYSTEMS OF PROPERTY RIGHTS

Include broadband connectivity in the definition of universal service

Defend and expand community broadband

Liberate orphaned and dormant (out of print) works

Reduce the burden of search costs to discover existing rights

PREVENT EXTENSION OF RIGHTS THAT IMPAIR COLLABORATION

Oppose discrimination in communications networks

Resist copyright holders defining communications architecture to protect their rights

Refuse to create new transmission privileges (e.g. the webcaster treaty)

Oppose technology mandates that undermine functionality (e.g. the broadcast flag)

Oppose excessive enforcement measures (e.g. criminalization or expansion of secondary or vicarious liability

Network neutrality is vital to supporting the economics of collaboration. Tollgates and barriers restrict the flow of information and the ability of groups to form. Policymakers must resist the efforts of incumbents to throttle down the flow of information in the digital communications platform. As long as wire owners have leverage over last mile, middle mile, or backbone facilities, they cannot be allowed to

---

[213] *See* Brief of Creative Commons, *supra* note 145.

undermine innovation in applications and content by withholding network functionality or discriminating against content or applications. Ironically, the torrent has barely begun and the oligopoly network owners are already complaining about bandwidth hogs consuming too much capacity, which will set off a campaign to restrict communications by price, or profit maximizing discrimination. Differentiation that utilizes enhanced network functionality is fine; discrimination that denies access to network functionalities is not. Open interfaces that promote seamless communications must remain the organizing principle of the network. The unfettered, many-to-many quality of the network must be preserved.

Telecommunications is infrastructure in the digital information age. More than ever, a ubiquitous and adequate communications network that is available, accessible, and affordable for all should be the objective of public policy. Because communications are so central to this economy, it is absurd not to have an industrial policy to ensure the achievement of this public policy. Universal service is more important in the 21st century than it was in the 20th because it creates a large market. In this network the sources of efficiency and innovation are dispersed and, frequently, accidental or surprising. The next big thing is not likely to come from the research and development departments of the incumbents.

There is a wide range of intellectual property issues that swirl around collaborative production, too many to address in this paper. From the point of view of information flow and communications, content owners should not dictate network architecture. If Hollywood and the music companies have their way, they will tag every file, fingerprint every user, and monitor every transaction. They will do so by forcing transactions back through a central server, which undermines the efficiency of exploiting distributive resources in peer-to-peer networks.

EFFICIENCY GAINS AND CONSUMER BENEFITS OF UNLICENSED ACCESS TO THE PUBLIC AIRWAVES

THE DRAMATIC SUCCESS OF COMBINING MARKET PRINCIPLES AND SHARED ACCESS

MARK COOPER
SENIOR ADJUNCT FELLOW, SILICON FLATIRONS
UNIVERSITY OF COLORADO, BOULDER

JANUARY 2012

CONTENTS

LIST OF EXHIBITS

EXECUTIVE SUMMARY

1. Economic theory predicts that removing barriers to entry in the market for radio spectrum usage improves the static and dynamic efficiency of utilization of this scarce resource.

In particular, theory suggests that removing the spectrum barrier to entry by allowing unlicensed access will: (1) decentralize decision making, (2) Deconcentrate investment; (3) Improve spectral efficiency;

- Allow user innovations;
- Promote end-user focus;
- Capture externalities; and
- Lower transaction costs.

Unlicensed use also enriches the wireless ecology because it creates a diversity of ownership models, which in turn increases value, enhances innovativeness, promotes resilience, and supports pluralism.

2. Economic reality shows that shared use of the public airwaves has lowered consumer costs and increased consumer value by billions of dollars.

The unlicensed model has equaled or exceeded the exclusive licensed model, on which cellular service providers primarily rely, on all the key measures of economic output performance, including:

- Use;
- Value;
- Applications;
- Efficiency; and
- Innovation

3. The economic value created and innovations developed by using unlicensed spectrum have been achieved even though shared use has been confined to relatively small slivers of low-quality spectrum.

Unlicensed use is largely restricted to frequency bands that were crowded with non-commercial noise or possessed propagation characteristics that were unattractive to communications service providers.

- Shared use has been virtually shut out of access to the most attractive spectrum, which lies in frequencies in the 500 MHz to 1 GHz range.
- The FCC's decision to allow shared use of the TV "White Spaces" is threatened by some legislative proposals to auction all high-quality spectrum.

4. If policymakers create more space for unlicensed uses in higher-quality spectrum, the best is yet to come.

Expanded shared use will allow carriers and other service providers multiple new opportunities, including:

- A greater ability to carry traffic offloaded from cellular networks;
- Increased coverage of Wi-Fi and similar technologies;
- Expansion of rural broadband deployment; and

- Support for many more business services.

5. Auctioning spectrum without making more unlicensed spectrum available will undermine the future success of the shared use model by starving it of a critical input and/or imposing conditions that undermine its core value.

Large incumbent telecommunications companies have gobbled up spectrum by mergers and acquisition and through auctions to such an extent that the top four firms control over four-fifths of the spectrum potentially useful for wireless broadband. The large incumbents dominate auctions because they

- Have deep pockets;
- Possess communications infrastructure;
- Concentrate demand and decision making; and
- Have a strong incentive to bid — suppressing competition.

Large incumbent telecommunications carriers will not allow access to exclusive licensed spectrum on terms and conditions that would allow the unlicensed use model to thrive. They are certain to encumber access to the spectrum,

- They will have a strong economic incentive to exclude "free riders."
- They will charge for use of "their" spectrum.
- They will resist applications that might compete with their core businesses.
- They will seek rents from new applications that do not compete.

6. Auctions will result in little, if any, additional spectrum being made available for shared use.

- Many of the beneficiaries of shared use are unknown. While we can predict that there will be economic benefit associated with unlicensed spectrum, it is difficult to identify in advance precisely what form that benefit will take.
- Firms that supply shared use devices and applications generally have less access to capital than the massive telecommunications bidders at auction.
- Because device and applications developers are not telecommunications companies, access to spectrum is likely not necessary to their core business models.
- They are also likely to lack expertise in negotiating the processes of an FCC auction.

7. Making high-quality spectrum available for shared use will increase federal revenues and reduce the deficit.

- First, if the supply of spectrum for exclusive licenses is reduced, cellular providers will bid up the price of the spectrum that is auctioned. Given that the cellular service providers have declared a "spectrum crisis," it would be reasonable to assume that they will bid up the price substantially.
- Second, the expansion of economic activity associated with the spectrum made available for shared use not only generates tax revenues, but it also does so at a higher tax rate than exclusive licenses because the purchase price of the spectrum is not claimed as a business expense.

I. INTRODUCTION

Experiments in Deregulation

Over the past decade, the growth of mobile communications has been nothing short of remarkable. Although wireline telephone service has been available for over a century and wireless voice became widely available in the late 1980s, globally the number of people who subscribe to wireless voice is four times the number of people who subscribe to wireline connections, with 80 wireless subscribers per 100 people worldwide in 2010.[1] In the United States, there are twice as many wireless subscribers as wireline telephone subscribers.[2] In fact, the penetration of wireline telephone service has begun to decline in the United States and globally.

However, the mobile communications revolution is now entering into a new phase, as new technologies make broadband Internet access service available with mobile devices like smartphones, laptop computers, tablets and other consumer electronic devices. Today, more people subscribe to wireless broadband Internet service than wireline broadband Internet service, globally.[3] In the United States, wireless and wireline broadband service subscriptions are about equal even though wireline Internet access has been available for a longer period of time.[4]

The mobile communications revolution has been built upon two very different and successful approaches to the management of spectrum that were made possible by a remarkable, U.S. led, real-world experiment.[5] In the early days of radio communications, policymakers chose to manage interference in radio transmission by granting an exclusive license to one user to transmit signals on specific frequencies, called bands, in a specific geographic area for a specific purpose. For three quarters of a century this approach led to the dominance of broadcasting in the commercial use of the airwaves. In the mid-1980s the Federal Communications Commission (FCC) altered the regulatory regime for access to spectrum and created the opportunity for dramatic improvements and changes in the use of spectrum for communications purposes. [6]

The FCC established the basis for two different approaches. Exclusive licenses were made available to allow new, two-way communications, and later, licenses were auctioned to the highest bidder.[7] The licenses were still exclusive, but the bidding and flexibility were intended to improve the utilization of spectrum by assigning the rights to those who were willing to pay the highest price. At the same time, the FCC identified some bands where there would be no licensee and interference would be avoided by the use of new technologies (spread spectrum) and restrictions on the amount of power devices could use. Anyone and everyone could transmit in these unlicensed bands as long as the devices obeyed the rules.

The original approach to interference management through spectrum allocation and the two new approaches have been described in a number of ways – command and control v. property

[1] ITU, 2011.
[2] FCC, 2010; CTIA, 2011.
[3] ITU, 2011.
[4]FCC, 2010. Based on company financial statement, the number of cellular wireless broadband subscribers for year-end 2011 would be to close 100 million.
[5] Lemstra and Groenewegen, 2011, p. 4, "Moreover, the example set by the FCC in the assignment of radio frequency bands for use by radio LANS has been followed by assignments by national regulatory agencies in the countries of Europe and Asia, including Japan, South Korea, India and China, thereby creating a global market for Wi-Fi products."
[6] Wehrbach, 2002
[7] The first two licenses were given to incumbent wireline telecommunications providers.

v. commons;[8] administrative v. tradable/flexible/market-oriented v. license exempt commons.[9] However, the simple labels do not do justice to the differences and similarities between the models. For example, it can be argued that the license-exempt approach is more market-oriented than the tradable/flexible exclusive licensed approach because it invites much greater entry and competition at the device and service levels. At the same time, the license-exempt model is far from a free-for-all, since the FCC certifies devices that must comply with very specific rules for their operation (in effect "licensing" devices rather than uses or users). Indeed, the FCC still administers the regime of rights enjoyed by spectrum users under both of the newer models.

The labels – with the intense ideological baggage they carry and rhetorical combat they inspire – are less important than the incentives the models provide and the economic performance that they achieve. [10] In fact, it can be argued that the labels have become a hindrance to clear analysis and policy recommendations. Fortunately, the theoretical/theological debate has been rendered moot by empirical reality. In a little more than a decade, the two institutional arrangements have come to stand side-by-side in remarkable balance and symbiosis.

THE UNIQUE SUCCESS OF THE UNLICENSED SPECTRUM MODEL FOR BROADBAND COMMUNICATIONS

Although both of the new models have been quite successful, the success of unlicensed use was quite surprising. A June 2004 article in the *Economist,* written before exclusively licensed wireless broadband Internet access had achieved significant market penetration, captures the unique and powerful economic forces that created the initial success of the unlicensed use model.[11] The article identified a number of key developments in the unlicensed wireless space.

- By 2004, there was a high level of activity already taking place in the unlicensed use spectrum.[12]

---

[8] Carter, 2006.

[9] Horvitz, 2007, p.1, "It is widely accepted today that there are three main approaches to radio spectrum management: The traditional "administrative" approach, in which a regulator decides who can use what frequencies for what purposes in what locations under what conditions: The newer "tradable/flexible/market-oriented" approach, in which those who are authorized to use spectrum are allowed to re-purpose or transfer some or all of their rights. Tenders or auctions are typically used for the initial distribution of rights. "License-exempt commons" in which any number of users are allowed to share a band with no right of non-interference and no right to cause interference."

[10] The debate between licensed and unlicensed spectrum frequently plays out, in footnotes at least (see e.g. Thanki, 2009), as a debate between two Nobel laureates in economics. On one side is Ronald Coase, whose 1959 essay highlighted the inefficiency of the licensing scheme at the FCC and is taken to be an argument for auctioning spectrum by neoclassical economists. On the other side is Eleanor Ostrom, whose work has demonstrated that efficient and effective non-property approaches to management of common pool resources are possible. Defenders of the unlicensed model claim Coase for their own, by arguing that a change in technology that significantly altered transaction costs could easily lead to a different conclusion about the relative merits of different institutional arrangements (Benkler, 1999, 2007; Ryan, 2005). The New Institutional Economics accommodates both possibilities by focusing on institutions as one, critically important element of economic structures, along with transaction costs and technology. As Douglas North (1990, p. 118) , another Nobel Laureate, put it, "Institutions provide the basic structure by which human beings throughout history have created order and attempted to reduce uncertainty in exchange. Together with the technology employed, they determine transaction and transformation costs and hence the profitability and feasibility of engaging in economic activity. (p. 118)." This is consistent with North's view that Coase's argument can lead to a fundamental critique of neoclassical economics (Douglas North, 1993, "It was Ronald Coase (1937 and 1960) who made the crucial connection between institutions, transaction costs and neo-classical theory; a connection which even now has not been completely understood by the economics profession. Let me state it baldly. The neoclassical result of efficient markets only obtains when it is costless to transact. When it is costly to transact, institutions matter. And because a large part of our national income is devoted to transacting, institutions and specifically property rights are crucial determinants of the efficiency of markets. Coase was (and still is) concerned with the firm and resource allocation in the modern market economy; but his insight is the key to unraveling the tangled skein of the performance of economies over time, which is my primary concern.")

[11] Economist, 2004, provides some early data. Lemstra, Hays and Groneween, 2011, provide more detailed and formal social scientific analysis.

[12] Economist, 2004, "Tens of millions of Wi-Fi devices will be sold this year including the majority of laptop computers. Analysts predict that 100m people will be using Wi-Fi by 2006. Homes, offices, colleges and schools around the world have installed Wi-Fi equipment

- The activity was driven by the close, complementary relationship that had developed between the adoption of broadband Internet access and the expansion of unlicensed use.[13]
- The level of unlicensed activity was particularly notable because the activity took place over spectrum to which experts had previously ascribed little value.[14]
- A self-regulatory approach to standard setting played an important role.[15]
- The broader significance of the success of the unlicensed use model and the prospects for further innovation it embodied were already notable.[16]

The contribution of the unlicensed use model to the wireless ecology in the period after 2004, when cellular broadband service based on exclusive licenses began to gain large numbers of subscribers, is equally impressive and continuing to evolve. It is driven by spectral efficiency,[17] deepening complementarity between licensed and unlicensed uses,[18] and the continual development of new arrangements that integrate the technologies and ownership models.[19]

PURPOSE: FRAMING THE ANALYTIC AND POLICY QUESTIONS

The dramatic developments in the wireless sector in the past decade and the success of the unlicensed model have been so swift and unexpected that its implications for policy have not been

---

to blanket their premises with wireless access to the internet. Wi-Fi access is available in a growing number of coffee-shops, airports and hotels too." Data on devices can be found in Lemestra, 2011a.

[13] Economist, 2004, "Wi-Fi was boosted by the growing popularity of high-speed broadband internet connections in the home; it is the easiest way to enable several computers to share a broadband link… fee-based access points known as "hot spots" also began to spring up in public places." The importance of the transition to the home environment is noted in Lemstra, 2011b.

[14] Economist, 2004, "Wi-Fi seems even more remarkable when you look at its provenance. It was, in effect, spawned by an American government agency from an area of radio spectrum widely referred to as the "garbage bands." Technology entrepreneurs generally prefer government to stay out of their way: funding basic research, perhaps, and buying finished products when they emerge on the market. But in the case of Wi-Fi, the government seems actively to have guided innovation… [T]o open several bands of wireless spectrum, allowing them to be used without the need for a government license... was an unheard of move at the time… But the FCC, prompted by a visionary on its staff, Michael Marcus, took three chunks of spectrum from the industrial, scientific and medical bands and opened them up to communications entrepreneurs."

[15] Economist, 2004, "What ultimately got Wi-Fi going was the creation of an industry-wide standard… Inspired by the success of Ethernet, a wireline-networking standard, several vendors realized that a common wireless standard made sense too. Buyers would be more likely to adopt the technology if they were not "locked in" to a particular vendor product." Jacob, Lemstra and Hayes, 2011, describe the standard setting process.

[16] Economist, 2004, 'Wi-Fi's ultimate significance, then, may be that it provides a glimpse of what will be possible with future wireless technologies. It has also changed the way regulators and technologists think about spectrum policy. The FCC has just proposed that broadcast "whitespaces" – the airwaves assigned to television broadcasters but not used for technical reasons – should be opened up too. That is not to say that spectrum licensing will be junked in favour of a complete free-for-all over the airwaves. Jules Knapp, the deputy chief of the office of engineering and technology at the FCC, maintains that both the licensed and unlicensed approaches have merit." Roseel and Finger, 2011, examine the future of Wi-Fi within the constraints of current spectrum allocation.

[17] Rysavy, 2010b, p. 10, Cisco, 2011a, p.1, "Cellular carriers are looking for solutions to offload this data traffic from their cellular networks. Offloading data to hotspots is an economically attractive alternative because many carriers already operate a substantial number of hotspots," Higginbotham, 2011, "Given the demand for data, this heterogeneous network is the future of mobile broadband, and could lead to lower operating costs and perhaps cheaper prices for end users."

[18] Cisco, 2011a,p. 1, "With the introduction of smartphones such as Apple's iPhone and Google's Android platform and the transition from a mobile voice to a mobile data model, more tier-one operators are taking a closer look at how to take advantage of the unlicensed spectrum and Wi-Fi as part of their mobile strategy. They are starting to realize that the operator with the best licensed **and** unlicensed strategy will deliver the most data service and the best mobile experience at the higher profit margin… Mobile operators would like to provide a user experience on Wi-Fi networks similar to that provided on 3rd generation networks. This means making Wi-Fi as easy to use as cellular and providing it with cryptographically equivalent mutual authentication and line-layer security."

[19] Higginbotham, 2011, "Japan's KDDI has seen the future of b: cellular service, and Wi-Fi has a starring role. The mobile operator will build out a Wi-Fi network composed of 100,000 hot spots and a WiMAX overlay that will take traffic off the cellular network when needed and will integrate seamlessly with the carriers exiting 4G network. … What KDDI has done is take the jerry-rigged AT&T or Verizon approach to Wi-Fi, whereby a mobile operator provides access to free hot spots but relies on the user to do the work, and tossed it out the window. KDDI has brought Wi-Fi (and WiMAX) into its network and made it work together in a way that will proactively keep its cellular network less congested."

fully recognized. Ironically, the success of the unlicensed model has not been studied rigorously by the agency that made it possible. The counts of subscribers that are used to demonstrate the success of mobile communications and that receive the overwhelming attention of regulatory bodies and agencies focus almost entirely on cellular services offered by holders of exclusive licenses. The FCC publishes annual reports on the Commercial Mobile Radio Service market[20] and semi-annual reports on mobile and wireline broadband adoption,[21] but it does not produce any regular reports on the use or development of unlicensed spectrum. Indeed, it has never conducted a comprehensive, rigorous examination of the performance of the unlicensed sector. In a deregulatory age one of the most successful experiments in radical deregulation has received almost no analytic attention from the FCC.

Similarly, some leading analyses of spectrum policy have not come to grips with the success of the unlicensed model. For example, an analysis by Thomas Hazlett,[22] one of the most vociferous opponents of the unlicensed use model,[23] provides a case in point. He frames the analysis not in terms of whether unlicensed has succeeded, but whether it has reduced the case for exclusive licensed model.

> Here, the question is: Have advanced technologies, yielding enhanced opportunities for wireless activities to be coordinated by smart technology, reduced the case for exclusive spectrum rights? In a word, *no.*[24]

Hazlett then offers an “acid” test by which to evaluate ownership models.

> If technologies operating on unlicensed bands were actually disruptive to the logic of exclusive spectrum rights, market activity would show evidence of a shift in usage patterns. Wireless investment would migrate to unlicensed bands. That transition has not been observed. Moreover, the competitive threat posed by unlicensed applications would devalue licenses.[25]

This view ignores the possibility of positive complementarity between the two models. Writing in 2008, with data through 2006, it might have been possible to downplay the development of hotspots and extension of broadband, which allows unlicensed use to be a complement to broadband Internet rather than a competitor. However, with the growth of offloading of traffic from exclusive licensed to unlicensed spectrum, the central role of unlicensed spectrum cannot be dismissed.

This paper addresses the analytic challenge of measuring “market activity,” “investment” and the “competitive” relationship between licensed and unlicensed spectrum with the full range of data from the first decade of broadband data delivery in unlicensed spectrum. The experience of the past decade makes it clear that the questions should be framed differently because of the complementarity between licensed and unlicensed spectrum.

First, we should examine the success or failure of the unlicensed model independently of the success or failure of the exclusive licensed mode. The first question should have been

[20] FCC, CMRs report,
[21] FCC, Internet Access Services reports
[22] Hazlett, 2008
[23]
[24]
[25]

- Have advanced technologies, yielding enhanced opportunities for wireless activities to be coordinated by smart technology, strengthened the case for unlicensed use models? And the right answer is an emphatic, *yes.*

The paper reaches that conclusion by using the measures demanded by Hazlett. The paper shows that, in fact, there **has** been a shift in market usage patterns. Investment **has** migrated. Complementarities between unlicensed use and exclusive use **have** increased the value of licenses. Examining the role of the unlicensed model in the overall success of the mobile data sector, the shows that in the delivery of mobile data the unlicensed use model has achieved success that equals or exceeds the exclusive licensed model by numerous measures of economic performance, including devices, users, usage, efficiency, innovation and economic value.

Second, with this evidentiary base, we can examine the implications of the performance of unlicensed for exclusive licensed spectrum. With the finding of complementarity between the two models, it can be argued that the case for exclusive licensing has been weakened by the performance of unlicensed use in the sense that, absent unlicensed use, wireless data would be more costly and less valuable and the sector would be less efficient and innovative. Consequently, the value of exclusive licenses would be lower without unlicensed spectrum.

Faced with a flood of traffic, the operators of networks based on exclusive licenses found it cost-effective to offload huge volumes of traffic onto the unlicensed spectrum. The solution advocated by the supporters of exclusive licensing to the ongoing spectrum shortage is to make more spectrum available on an exclusive basis. From a societal view, feeding the bandwidth hogs more spectrum is less efficient than making spectrum available for both models. In fact, based on the real world experience of the performance of the two models in the past decade, a good case can be made that unlicensed use has a stronger claim to spectral efficiency than exclusive licensed use. In this sense, with respect to the allocation of spectrum between the two models, it would "reduce the case for exclusive spectrum rights." However, the policy challenge does not have to be framed in that way. The policy question is not whether to choose one model; the policy question is how to support both to continue the dramatic expansion of the wireless data sector.

Filling this analytical gap is vitally important not only because unlicensed use has come to play such a large role in the wireless data space, but also because major decisions about the future of the exclusive licensed and unlicensed models are about to be made. The budget deficit debate in Congress threatens to undermine the future potential contribution of unlicensed spectrum because some policymakers are advocating auctioning all high-quality frequency bands (those between 500 MHz and 1 GHz that have been used by TV broadcasters) that come available to maximize short-term revenues without making any additional high-quality bands available for unlicensed use.[26]

The paper shows that focusing on short term revenues that would be raised by auctioning licenses, while ignoring the immense value that unlicensed spectrum creates, which would increase revenues much more than auction yields, is a mistake. It explains why failing to make more high-quality spectrum available for unlicensed use would severely constrain the development of the unlicensed use model, which would retard the development of the entire wireless broadband sector, stifle innovation, drive up consumer costs for service, reduce long-term growth and slow job creation. The net effect would be to lower federal revenues.

[26] *The Jumpstarting Opportunity with Broadband Spectrum Act of 2011,* required all spectrum that was cleared of broadcast licensees to be auctioned.

OUTLINE

To demonstrate this important policy conclusion, the paper offers answers to key analytic and policy questions.

Has unlicensed use been successful in generating activity and creating value?

- **Section II** reviews the key role that unlicensed use has played in the remarkable success of wireless data delivery, showing that there is at least as much activity

Has unlicensed use improved the efficiency of and innovation in the wireless broadband sector?

- **Section III** estimates the contribution of offloading of traffic to the efficiency of the wireless sector by estimating the number of cell sites that cellular carriers avoided erecting by shifting traffic to unlicensed bands.

What is the value of activity in the unlicensed space?

- **Section IV** shows that the value of activity in the unlicensed space equals or exceeds the value of activity in the exclusive licensed space.

Has the unlicensed model stimulated innovation?

Section V presents evidence that the speed of innovation under the unlicensed equals or exceeds the speed of innovation under the exclusive licensed model.

What role can the unlicensed use model play in providing future wireless data service?

- The past success of the unlicensed use model suggests that it can play an important role in the future of the wireless sector. Both **Section VI** offers evidence that there remains great potential for unlicensed spectrum to expand its contribution to wireless activity, value, efficiency, and innovation, if policymakers grant unlicensed access to higher quality spectrum.

Will auctioning spectrum provide the necessary spectrum for the unlicensed use model to continue to thrive?

- **Section VII** explains the success of unlicensed use in terms of the fundamental characteristics of the model. It then discusses the reasons why auctioning all spectrum will not result in making adequate spectrum availability for unlicensed use to expand. It concludes with recommendations for policies to ensure adequate spectrum is available to preserve the unlicensed option and the diverse, balanced development of the wireless communications ecology.

II. ACTIVITY AND VALUE

The unlicensed model has succeeded in supporting a large amount of economic activity in the wireless broadband space by bringing new and unique services to the market, increasing the value of broadband service by extending it to additional devices, and providing a lower cost, more efficient avenue to deliver data to consumers. Frequencies reserved for unlicensed use have come to support two broad categories of activities. Mass market activities involve widely available end-user-oriented activities including extension of broadband data transmission within the home/office and use of commercial hot spots. Unlicensed use bands have also become an important intermediate input used by businesses to support and improve their operations. These include the offloading of cellular traffic onto unlicensed spectrum to increase the efficiency of cellular service and the intensive use of intra-firm wireless communications by non-telecommunications firms and the "tagging" of things that are tracked in machine-to-machine (M2M) communications to manage their flow more efficiently.[27]

THE RAPID EXPANSION OF THE UNLICENSED SECTOR

Devices

Devices are the focal point of the unlicensed model, whereas cellular service providers, who rely primarily on exclusive licensing, focus on subscribers and subscriptions. This distinction introduces some complexity into comparing the models. The complexity is compounded dramatically by the fact that one of the primary uses of unlicensed spectrum is to extend fixed broadband to mobile devices and by the fact that cellular providers bundle access to unlicensed in their wireless broadband offerings. The two have become thoroughly intertwined.

The standard to support broadband devices in the unlicensed use bands was adopted in the United States in 2000. By 2004, there were 2,000 devices certified to operate in the unlicensed use bands subject to the 802.11 standard, which was 20 times the number of devices that had been certified for use in cellular licensed bands.[28] By 2007, there were over 3,500 devices certified for to operate in the unlicensed bands.[29]

As Exhibit II-1 shows, global shipments of devices were expanding rapidly over this period. From the "tens of millions" of devices sold in 2004 globally, as noted by the *Economist,* the market is approached 800-900 million sold in 2010-2011.[30] That is a compound annual growth rate approaching 50 percent. Since the life of a device is more than a year, the number of devices in use is probably in the range of 1.5 to 2 billion globally (assuming a two-year life). Moreover, the shipment of Wi-Fi capable devices is projected to double in the next five years.[31] Additionally, Wi-Fi functionality is being deployed in almost two dozen different types of devices and a growing number of devices (especially smartphones) are dual mode devices.[32] Thus, the distinction between licensed and unlicensed-capable devices is shrinking dramatically.

---

[27] Xxxx Although hotspots all provide a basic functionality, the term hotspots has come to be used to describe somewhat different business models. The term public hot spots generally refers provided at no charge at commercial enterprises. Private hotspots refer to hotspots offered to the public for a fee. Community hotspots are made available to members of a specific community, like students at a university. Cellular service providers use hotspots to offload traffic from their networks. The also sell personal hotspots that their subscribers can establish

[28] Snider, 2006

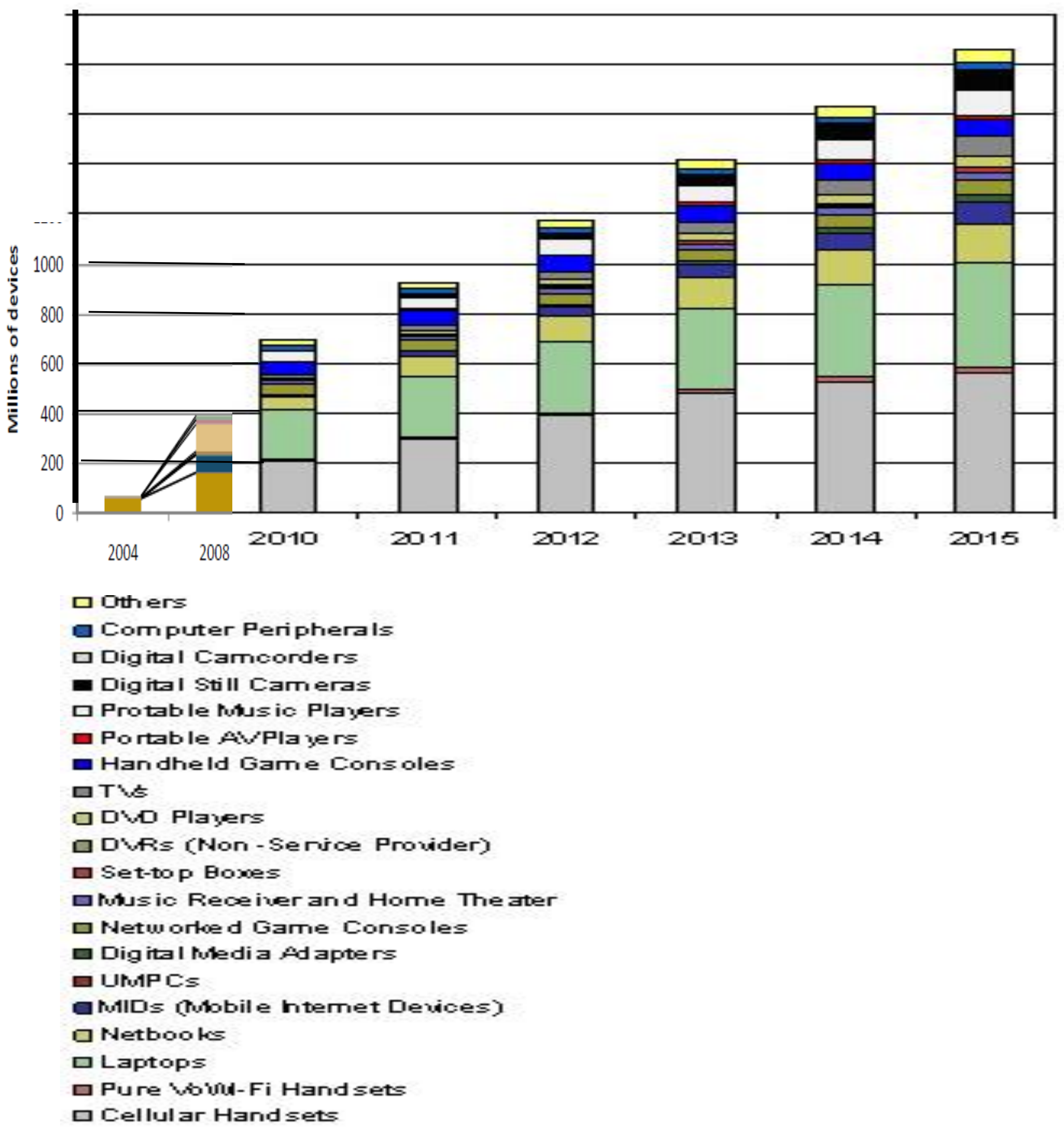
[29]

[30] Lynn, 2011; Flaherty, 2011b

[31] Flaherty, 2011b. Research and Markets, 2011, projects a higher rate of growth of Wi-Fi enabled devices in the U.S. than globally.

[32] Dual mode devices are about 40% of cellular devices (Portio Research, 2011) and one-third of shared use devices (Flaherty, 2011b).

EXHIBIT II-1: SHIPMENTS OF WI-FI CAPABLE DEVICES



Sources: Nick Flaherty, "Consumer Wi-Fi Drives Global Growth: Wi-Fi chip shipment to surpass 770 million in 2011?, up 33%," *The Embedded Blog,* May 26, 2010; Richard Thanki, *The Economic Value Generated by Current And Future Allocations of Unlicensed Spectrum,* Perspective, 2009. The underlying data in both cases is InStat. The exhibit is pieces together from published graphics.

The U.S. numbers are a little different. The United States accounted for one-quarter of global shipments of Wi-Fi enabled devices in in 2005, estimated to decline to one-fifth in 2007-2010.[33] U.S. cellular shipments were approximately 150 million Wi-Fi enabled devices per year in the years between 2007 and 2010. Looking at the numbers of devices shipped, and assuming a two year life for devices, the number in use in the United States would be 300 million. Given the rapid spread of

[33] King,2007.

dual mode smart phones and other Wi-Fi enabled mobile devices, the share of Wi-Fi enabled devices in total broadband wireless connectivity devices appears to be well over half.[34]

Users

Estimating the number of users of unlicensed spectrum is difficult not only because there is no centralized organization that charges for use, but also because the cellular providers who do charge have been bundling use of unlicensed spectrum into their paid services. Because the cellular operators control which spectrum is used in many cases, consumers may not even know when they are using unlicensed spectrum.

Globally, there are about 1.3 billion subscribers to wireless broadband service and a little over half as many wireline broadband subscribers.[35] The total wireline and wireless subscribers would be about 2 billion. However, a substantial number of those who subscribe to wireline broadband also subscribe to wireless broadband, so the total count of unique users would be smaller.

At the end of 2010, the FCC put the number of wireless broadband subscribers at 84 million, with an equal number of wireline broadband subscribers. However, there is a substantial overlap between the universe of wireless and wireline broadband subscribers in the United States. The Current Population Survey for October 2010 indicates that approximately two-thirds of wireless broadband subscribers are also wireline broadband subscribers, but the unit of analysis is the household, rather than the individual.[36] In a mid-2011 study, ComScore.com estimated that there were 116 million Wi-Fi users.[37] In subsequent analysis for year-end 2010, we use an estimate of 110 million Wi-Fi users.[38] Thus, disregarding overlap, the number of subscribers at the end of 2010 is as follows: 110 unlicensed users, 84 million broadband wireline and 84 million broadband wireless.

The percentage of all mobile data users who are unlicensed spectrum users can be estimated in two ways. If we count unique users of broadband (taking overlap into account) then unlicensed users would be over 90 percent of unique broadband users.[39] On the other hand, arguing that unlicensed spectrum and exclusive spectrum users are thoroughly conflated by the bundling strategy of cellular service providers and that the line between wireless and wireline subscribers is blurred by dual mode devises and extension of wireline broadband, we might include in the denominator of the fraction all broadband subscribers. Viewed in this way, users of unlicensed spectrum would be equal to almost two-thirds of the total.[40] This is consistent with the share of devices discussed above.

---

[34] Dediu,2011, cites a Nielsen finding that 43% of the phone in use in the U.S. are smartphones. Nielsen, 2011, for the third quarter of 2011 gives a figure of 44%. Adding tablets and notebooks into the analysis, smartphones account for about 70% of the mobile data devices. Hence dual mode devices account for over two thirds of the mobile connectivity devices.

[35] ITU, 2011.

[36] CPS, 2011, Figure 4.

[37] Comsource.com, 2011.

[38] Examination of quarterly SEC reports by the top four cellular carriers indicates that wireless carriers added about 6 million subscribers through mid-year 2011. Assuming that these all involved dual mode devises, subtracting this six million from the ComScore.com estimate yields a total of 110 million.

[39] The calculation is 110 million unlicensed users compared to ((84 million * 1, 33 broadband users = 112 million) + a small number of unlicensed only users).

[40] The calculation is 110 million unlicensed users compared to (84 million wireless broadband users + 84 million wireline broadband users = 168 million)

Thus measured by devices and users, unlicensed use appears to be a major contributor to broadband activity, with a share equal to or greater than that of cellular wireless broadband subscribers.

MASS MARKET USES OF UNLICENSED SPECTRUM

Extending Wireline Broadband

The key applications that drove early Wi-Fi adoption as described in the quote from the *Economist* were the extension of broadband internet connectivity to a number of devices and access to hot spots.[41] Within the home or business of a broadband subscriber, the ability to use Wi-Fi to extend the broadband service to all capable devices is ubiquitous because the spectrum is available for unlicensed use.[42] Anyone with a router can distribute the signal over a short range. The sale of routers has sustained a compound average growth rate over 30 percent for almost a decade.[43]

At present the major broadband Internet access providers, whether wireline or wireless, view Wi-Fi as a way to extend their broadband service to a host of devices.[44] They advertise the advantages of in-home mobility that Wi-Fi provides and they market wireless hotspot devices for personal use.[45] Just as modems quickly became a standard feature of desktop computers, Wi-Fi capability became a standard feature of any mobile device.[46] For example, in announcing a major deal to sell its spectrum to and enter into a joint marketing venture with Verizon, the President of Comcast Cable chose to highlighted it Wi-Fi strategy – "These agreements, together with our Wi-Fi plans, enable us to execute a comprehensive, long-term wireless strategy and expand our focus on providing mobility to our Xfinity services".[47]

The extent of home networking is difficult to pin down because home networking is generally bundled as an extension of broadband service. Once a signal is delivered into the home, the service provider who is paid for that signal does not measure its distribution to other devices because that distribution does not contribute to the congestion on the delivery network, nor does the use increase revenues. It is safe to say it is ubiquitous.

---

[41] *Meraki*, 2011, It took more than a decade for mobile devices to overtake fixed devices in Wi-Fi deployment, which highlights the "extension" function of Wi-Fi. "Between 2010 and 2011, mobile platforms overtook desktop platforms in percentage of Wi-Fi devices."

[42] Vonnagy, 2010a, "Consumer Wi-Fi has an immediate and substantial value proposition for consumers. It is a **gateway technology** that increases consumer adoption of many other technologies that have value to people. It allows them to access the Internet while on the couch or in bed; stream music from one room to another; it creates portability and flexibility for home offices, allowing people to move to another portion of the house. It's value to consumers is tremendous, largely because it gives people freedom to interact with the Internet and consumer content in the place and the method they choose. It breaks down barriers and allows people to interact on the web on their terms."

[43] Research and Markets, 2011b, *Global Home Networking and Broadband CPE Outlook through 2012,* xxx

[44]Comcast, 2011, "Wi-Fi is used to provide a high-speed wireless connection within a limited area (in tens of feet) like a home, office, or coffee shop. Wi-Fi is commonly referred to as a Local Area Network (LAN) technology. XFINITY Internet 2go Metro (4G) service is based upon a 4G mobile broadband technology called WiMAX. WiMAX provides mobile broadband network across a much broader coverage area than Wi-Fi. WIMAX is commonly referred to as a Wide Area Network (WAN) technology, due to its ability to provide a much broader coverage area; e.g., covering most a metro area, where available.

AT&T, 2011b, DSL: "Stay connected at home and on the go. Built-in wireless home networking capability included. Our Residential Gateway is powerful enough to virtually eliminate wireless dead spots and safeguard against outside access of your Internet connection. Also includes four Ethernet ports for wired LAN connections. AT&T Wi-Fi—email, watch streaming video, listen to music, and much more—all on the go. Includes access at home and on-the-go to the entire national AT&T Wi-Fi Hot Spot network, at no extra charge. ‡ ‡Access includes AT&T Wi-Fi Basic. Wi-Fi enabled device required. Other restrictions apply. See www.attwifi.com for details and locations. Use of Wi-Fi at home will count toward your AT&T high speed Internet usage allowance."

[45] Nadel, 2011.

[46] Vos, 2011, "carriers showed a strong and renewed interest in Wi-Fi as they look to build affordable capacity and coverage to augment their cellular networks, offer mobile data offload services and deliver fasters and more reliable Wi-Fi services."

[47] PRNewswire, 2011.

Hot Spots

Another unique aspect of the unlicensed use model has been the growth of hot spots.[48] Here again, measuring the extent of activity in the unlicensed space and comparing it to the exclusive licensed space involves complex considerations. On the one hand, one can argue that hot spots and cell sites provide the initial connectivity for end users. On the other hand, accessing hot spots over unlicensed spectrum is presently a very short range form of connectivity. However, to a significant degree, the difference in reach of unlicensed reflects the allocation of spectrum to the various models and the rules that have been applied to avoid harmful interference. Comparing hot spots to cell sites as connectivity points may be an apples to oranges comparison today, but that reflects a policy choice. The result is not immutable. Because the current distribution of capabilities reflects prior policy choices, they should certainly not be seen as "proof" that the future distribution of capabilities and functionalities must be similar to the past.[49]

Within the constraints of past policy choices, unlicensed connectivity has flourished. The frequencies set aside for unlicensed use are suited to short-range transmission, which was conducive to businesses offering access to a hot spot as an inducement to patronize the establishment. Just as bars find it effective to give away salty snacks to attract customers, a host of commercial enterprises have come to view free Wi-Fi as an invitation to customers to enter and linger.[50] Community hotspots at universities, government buildings and libraries were a second major area of activity that was supported by the allocation of spectrum and the rules. Later, the cellular carriers began to promote hot spots of their own. They advertise Wi-Fi access as a selling point in their mobile broadband offerings and support hot spot development. T-Mobile claims to support 45,000 hot spots globally.[51] AT&T claims 29,000 U.S. hotspots and access to 190,000 globally with roaming.[52]

Comparing cells sites and hot spots may be apples-to-oranges, but an analysis by HBSC from early 2010 compares hot spots and cell sites operated by major cellular service providers in a number of developed nations. HSBC argued that hot spots and cell sites are different forms of initial connectivity for the reasons noted above. However, the study shows a great deal of connectivity in both models, and the analysis was conducted before the biggest increase in offloading. Focusing on major wireless service providers only, with data through year end 2009, the ratio of hot spots to cell sites varied widely, from zero in Italy to five in Korea. In the U. S., counting only Verizon, AT&T and T-Mobile it stood at 0.4. Stated in another way, hot spots were already almost 30 percent of the available initial connectivity hops for these three carriers.[53] The

---

[48] "A **hotspot** is a site that offers Internet access over a wireless local area network through the use of a router connected to a link to an Internet service provider. Hotspots typically use Wi-Fi technology. have come to refer to a number of different services." http://en.wikipedia.org/wiki/Hotspot_(Wi-Fi). Access to the Internet can be made available under a wide range of conditions. Public hotspots are referred to as locations where commercial establishments make access available to any member of the public either for free or for a fee. Community hotspots are available to all members of a community (e.g. universities). Cellular carriers use hotspots to deliver broadband traffic to their subscribers sometimes by controlling which spectrum (the exclusive licensed spectrum or unlicensed), sometimes allowing the subscriber to make that decision. There are two other approaches that are not generally included discussion of hotspots, but they do not differ a great deal from what is generally referred to as a hotspot. Some cellular carrier sell the right (and equipment) to set up personal hotspots. When consumers use a router to distribute broadband data to devices in the household, it is not generally referred to as a hotspot.

[49] Benkler, 2011

[50] Vonnagy, 2010b, "Wi-Fi hot spots have long been a staple of cafes and bookshops, but will see increasingly broad adoption among other retailers looking to provide a mechanism for customer engagement while in store where they have the most influence at the product location. Wi-Fi will serve as a foundation for mobile commerce and marketing applications due to its pervasive presence in consumer smartphones and the lack of adequate 3G/4G cellular data network coverage within many brick-and-mortar facilities. "

[51] T-Mobile, 2011.

[52] ATT, 2011

[53] The calculation if as follows hotspots = (.4/1.3) *100 = 100%.

flood of data caused by mobile broadband was in its early stages, but the wireless carriers were already relying on unlicensed spectrum to provide a significant share of initial connectivity. In the year after the study AT&T increased its U.S. hot spots by 50%, Verizon embraced hot spots for its 4G network,[54] and KDDI in Japan launched a plan to quadruple the number of hot spots in that nation. The ratio would grow dramatically in the short-term for these service providers. There were also already a large numbers of hot spots operated by other, non-wireless providers. [55]

INTERMEDIATE INPUTS

Offloading Cellular Traffic

The unlicensed use model was successful even before cellular broadband Internet access had gained much traction in the marketplace but when cellular broadband became widely used, unlicensed use moved to the center of the mobile communications revolution because unlicensed access allowed more efficient use of scarce radio spectrum. In a sense, the most important intermediate input use of unlicensed spectrum is the offloading of traffic from the cellular network to the unlicensed space.[56]

Cellular providers simply could not handle the huge quantity of traffic that mobile Internet access generated without making massive investments in their own infrastructure.[57] Network operators found it less costly to offload traffic to bands reserved for unlicensed use than to build more towers and/or increase the number of cells in their networks.[58] Use of Wi-Fi devices to deliver data in the bands reserved for unlicensed use is such an attractive approach to utilizing spectrum that over one-third of the Internet bound mobile data traffic carried by the cellular licensed wireless carriers is offloaded to the unlicensed use bands and the percentage is expected to grow over the next decade.[59]

AT&T was the first of the major U.S. cellular service providers to embrace Wi-Fi. In the two years after AT&T embraced Wi-Fi in an effort to provision connectivity with the launch of the iPhone, its Wi-Fi connection grew four times as fast as cellular wireless industry messages.[60] In the three years that AT&T has been reporting hot spot connections, they have increased at an average, compounded annual rate over 270% and the rate of growth has been increasing or stable.[61]

ComScore.com estimated that 37 percent of smartphone traffic was offloaded by cellular carriers by mid-2011. While smartphones have increased their market share, other devices like tablets, laptops and consumer electronics still represent half of the Wi-Fi enabled devices sold.

[54] Goldstein, 2011; Maisto, 2011.

[55] http://www.hotspot-locations.de/?newlang=english

[56] Chapin and Lehr, 2011, p. 10, "In offloading, mobile devices remain registered on their home network, but when appropriate, transfer data for specific applications via the offload network. Normally mobile devices have a separate radio chip enabling them to communicate via the primary network and the offload network at the same time, which is a key difference from the roaming model. For example, smartphones are able to receive a phone call via a 3G network while transferring data over a Wi-Fi network. There is a strong synergy between infrastructure sharing via an offload network and spectrum sharing… Thus, there is much more spectrum available for the offload network than would be available for a CMRS class network capable of supporting roaming."

[57] Wirelesse2e, 2011

[58] Juniper Research, 2011.

[59] *Wirelesse2e, 2010*,"Last 8-10 years have shown that Wi-Fi is the superior choice even with the very limited 2.4 GHz band. We estimate 30-40 % of wireless traffic is already carried over Wi-Fi in developed world where the wired infrastructure is more readily available. Majority of this offload is at home and this traffic grows to be a larger segment of overall traffic. Real Wireless/Ofcom report predicts at-home use will reach 58% of total traffic by 2013. When the office use is added, the total opportunity goes up to 85% of overall traffic."

[60] Cristi, 2010.

[61] Solsman, 2011; WNN, 2010.

These other devices consume six times as much data and rely on Wi-Fi for a much larger share of their transmission (over 90 percent).[62] If these non-smartphone devices represent one-third[63] to one-half of all devices,[64] then unlicensed use spectrum carries about 80 percent of the traffic.[65] These estimates do not fully take into account business applications, which can make very intensive use of unlicensed use spectrum.

Intermediate Inputs and the Internet of Things

The intermediate use applications of unlicensed use bands are more varied and emerging, but they are still a substantial sector. Projections show that this application group will become widespread, with tens of billions of devices connected wirelessly in the decade ahead.[66]

> The Internet and wireless communications services have grown in recent decades into mass market infrastructure. Their on-going convergence holds the promise of a pervasive communications fabric that is always and everywhere accessible for everyone and everything that wants to communicate. With such a capability comes the prospect of widespread automation and real-time control of real-world systems, or equivalently, the cyber-real world convergence.[67]

> The Internet is growing up and lifting its gaze… the protean Internet technologies of computing and communications are rapidly spreading beyond the lucrative consumer bailiwick. Low cost sensors, clever software and advanced computing firepower are opening the door to new uses in energy conservation, transportation, health care and food distribution.[68]

Benkler (2011) considers a broad range of applications and focuses on the market shares between unlicensed use and exclusive licensed use models. He considers applications that fall into the two broad categories used here. In the mass market category, which Benkler calls mobile broadband, he reaches conclusions about the amount of activity that are similar to those set forth here.[69] In the intensive internal business category, he examines the unlicensed use and exclusive licensed use technologies being used in applications like smart grids and health care. The machine-to-machine/RFID applications involve asset management, access control, mobile payments and fleet management. As shown in Exhibit II-2 with the exception of fleet management, Benkler's

---

[62] xx
[63] ComScorce.com, 2011.
[64] Wireless Broadband Alliance, 2011.
[65] The calculations are as follows:
For each category of device Multiply I x II x III = Device weighted cellular traffic.
For each category of device Multiply I x II x IV = Device weighted Wi-Fi traffic.
Sum cellular traffic
Sum Wi-Fi share traffic
Wi-Fi share = Wi-Fi weighted traffic/(Wi-Fi weighted traffic + Cellular weighted traffic)

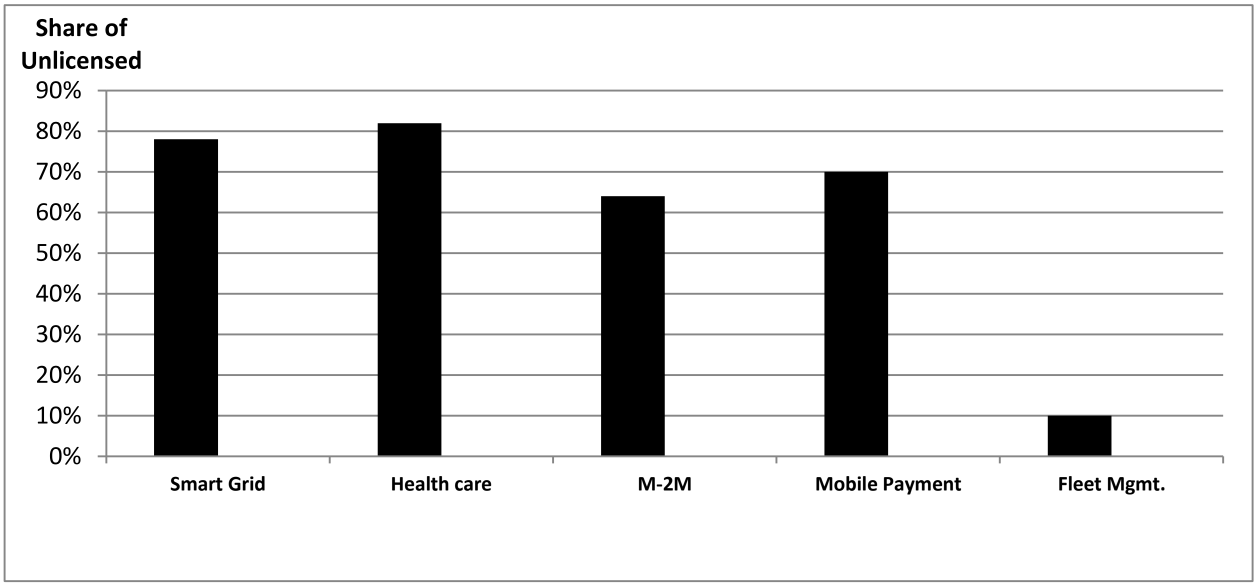
	I	II	III	IV	V=I*II*III	VI=I*II*IV	VII= (VI/(VI+V))*100
Device Share	Market Weight	Data Weight	Cellular Share	Wi-Fi Share	Cellular Total	Wi-Fi Total	Wi-Fi %
50/50 case							
Smartphone	.50	1	.63	.37	.315	.185	
Laptop/Tablet	.50	6	.10	.90	.3	2.7	
Total					.615	2.885	82.4
65/35 Case							
Smartphone	.65	1	.63	.37	.41	.241	
Laptop/Tablet	.35	6	.10	.90	.21	1.89	

.
66

[67] Chapin and Lehr, 2010a, p.1,
[68] Lohr, 2011.
[69] Benkler, 2011, pp. 5-8

conclusion is overwhelmingly clear; the major of activity is taking place in the unlicensed use bands.

EXHIBIT II-2: SHARES OF UNLICENSED SPECTRUM IN INTERMEDIATE INPUT WIRELESS DATA ACTIVITY



Sources and Notes:

Intermediate Inputs: Yochai Benkler, *Unlicensed Wireless vs. Licensed Spectrum: Evidence from Market Adoption,* 2011. Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum,* Perspective, 2009, provides dollar estimates for health care and tagging in the retail sector.

Because the services are bundled and comingled, some measured, some not, some billed and some not, apportioning activity or, as we shall see in Section IV, value between them is inevitably imprecise. In fact, the take away from this analysis should be that the use and value are thoroughly interwoven and interdependent. Indeed, one author finds that as much as 80 percent of end user traffic that flows on the networks operated by cellular broadband carriers who have embraced unlicensed spectrum reaches the consumer with an initial Wi-Fi hop.[70]

[70] Iluna, 2011., "Generally speaking, those operators that have aggressively embraced a Wi-Fi offloading strategy, such as PCCW and AT&T Mobility, estimate that about 20 percent of their overall data traffic is riding over Wi-Fi networks…. and it's likely that another 60 percent is landing on home Wi-Fi networks now that the operator has instituted tiered data plans."

III. ECONOMIC EFFICIENCY

THE IMPORTANCE OF UNLICENSED USE TO EFFICIENCY

In the case of the cellular embrace of Wi-Fi, necessity is the mother of acceptance.[71] The reliance on Wi-Fi is much more than just a convenience; it represents a fundamentally different approach to provisioning initial connectivity that some analysts believe is the inevitable long-term solution for wireless broadband communications. The key to the efficiency of offloading traffic onto unlicensed use spectrum as implemented by the FCC is the fact that all unlicensed use spectrum is available to all users all the time. This has the effect of making more available to every user, as long as interference is effectively controlled by the rules of sharing.

> Operators are already using Wi-Fi for effective data offload on their 3G networks. This is an excellent application of Wi-Fi because the technology can deliver much higher throughput in small coverage areas to more people than is possible with cellular technologies. Not only is there more unlicensed Wi-Fi spectrum available than the amount of spectrum licensed to any individual cellular operator, but since coverage areas are much smaller, frequency reuse is much higher, and thus there is more bandwidth available to each subscriber.[72]

Evaluating the impact of offloading of traffic involves a counterfactual analysis. What would the network have looked like if offloading had not been available as a strategy? Conceptually, the answer is simple. The wireless providers delivering high speed data service would have had to build many more cell sites, shrinking their size to support the huge increase in data flows. The industry would have been less efficient – the cost of service would have increased and demand decreased. How much difference would it have made? Broadly speaking, with one-third or more of the traffic being offloaded, the answer is, it would have made a big difference.

Providing a more precise answer involves assumptions, as suggested by Exhibit III-1. Exhibit III-1 shows the key data on subscriptions in two ways to highlight the analytic challenge. The top graph in Exhibit III-1 shows the number of cellular subscriptions and cell sites. Viewed in this way, the number of subscribers increased by over 85 percent from the end of 2004, when they started adding broadband service, until the middle of 2011. The number of cell sites grew at about half that rate.

---

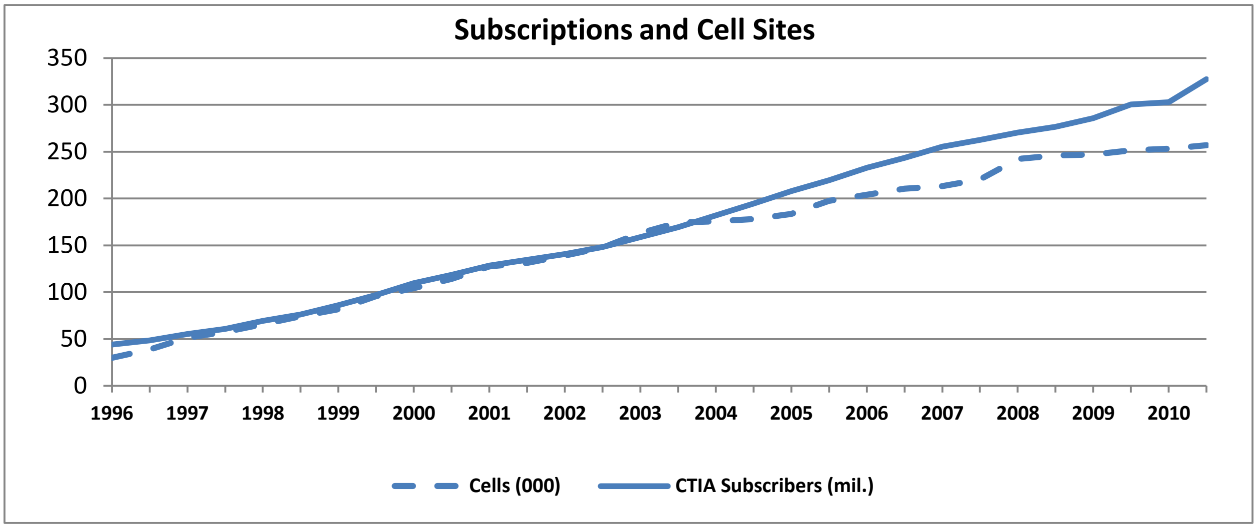
[71] Iluna, 2011. "offloading smartphone mobile data traffic onto Wi-Fi networks is becoming a key network requirement for operators around the world as they grapple with heavy data traffic. But interestingly enough, those operators that have embraced the offload concept have difficulty quantifying its ability to reduce 3G network congestion or solidly demonstrate its cost advantages. They just know it works…the effectiveness of offloading for PCCW and other operators is difficult to measure primarily because the data traffic doesn't all end up in the same place. It may bounce between the Wi-Fi connection and the 3G connection and end up terminating on the 3G network again. Moreover, operators cannot simply look at smartphone traffic traveling over Wi-Fi networks and conclude that the traffic would have moved over 3G had the hotspot not been available. The accessibility and the growing number of Wi-Fi enabled smartphones tends to drive up traffic on Wi-Fi networks. Not only does data traffic increase on Wi-Fi networks, but analysts say it drives up traffic on 3G networks as well." Wi-Fi has taken away congestion but generated more usage. But still, you need it," "Wi-Fi offload will become a crucial part of an operator's network. ... It would be challenging for operators to carry everything on their networks. "Wi-Fi causes people to use things they may not have otherwise," he said. "It may be generating more traffic, but it's likely taking more of that traffic off 3G. Wi-Fi offload is going to continue being part of the solution."

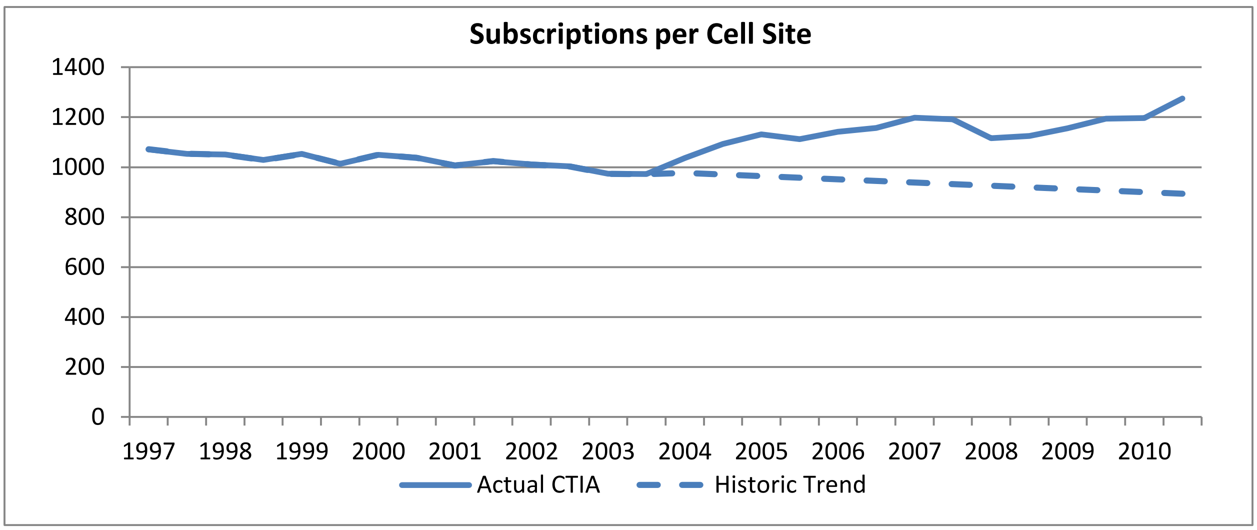
Woyke, 2011, "It would seem there is a relatively simple solution to the wireless data deluge faced by mobile operators: shift the traffic that is tying up their networks to Wi-Fi hotspots whenever possible… Wi-Fi is available and represents a cheaper alternative to cell connections… Forbes has learned that three of the four largest U.S. carriers are testing technology from Tel-Aviv-based startup WeFi that lets them point subscribers' smartphone to private and public Wi-Fi networks whenever practical.

Lamberth, 2011, "White Space and the Internet of Things," *MSolve Partners Newsletter,* September 2011. TV stations and cellular network operators used their spectrum the most with 50-90% and 30-50% utilizations respectively on average. The rest of spectrum bands were occupied 25% of the time, or less, with 18 of the 32 bands studied averaging less than 10%. These results are similar to SSC's 2005 study finding similar low spectrum occupancy rates in Chicago and New York."

[72] Rysavy, 2010b, p. 7.

EXHIBIT III-1:
GROWTH OF SUBSCRIBERS, SUBSCRIPTIONS AND CELL SITES





Source: CTIA Semi-annual Industry Survey, 2011

The bottom graph in Exhibit III-1 shows the number of subscribers per cell site over this same period. It shows a sharp break in the trend even using the CTIA count of subscribers. The number of subscribers per cell site had declined steadily until the end of 2004, but then began to rise markedly. If the historic trend had continued, by 2010 there would have been 25 percent fewer subscribers per cell site. The analysis of the count of cell sites and subscriptions underestimates the burden that was being placed on the network. Broadband data subscribers use a great deal more bandwidth and the growth in the number of broadband subscribers in the past half-decade has been substantial. The need for cell sites and the resulting shortfall was much greater than the count of subscription indicates.

QUANTIFYING THE EFFICIENCY GAINS

This analysis highlights the fact that the estimate of the shortfall in cell sites hinges on the question of how broadband subscriptions affect the need for cell sites to handle their traffic. Since broadband subscribers and voice subscribers share some plant, it might be argued that adding broadband subscribers only increases the need for cell sites at the margin. On the other hand, broadband subscribers generate traffic that is several orders of magnitude greater than voice subscribers. From this perspective, one might argue that the marginal increase in cell sites to serve them is greater than the average. In other words, the addition of broadband pushes cellular wireless into a region of the supply curve that involves rising marginal costs.[73]

Perhaps the cellular providers thought that the new technology that used spectrum more efficiently would allow them to meet demand with fewer cells. In the period in which offloading became a prominent feature of the wireless broadband ecology, i.e. ten quarters from year-end 2008 to mid-2011, the industry added 15,000 cell sites. In the ten quarters preceding the offloading period, when the industry began to roll out wireless broadband service, the cellular providers added three times as many cell sites. The hope that new technology would be able to handle the flow of traffic proved incorrect, given the dramatic increase in data flow that came with broadband service.

By one estimate, users of smart phones, the most common connectivity device for accessing unlicensed use bands, generate over twenty times the traffic of the user of a standard handset.[74] Tablets, the second most common type of connectivity device, generate over 100 times as much data.[75] The spectral efficiency gains of the new technologies being deployed to provision wireless broadband are in the range of 2 to 4 times, which are paltry compared to these increases in use. The historical trends of declining subscribers should have accelerated, not ended as these new services were rolled out.

Hallahan and Pena argue that service subscribers who use voice and data require almost 1.9 times as many cells, on average (2.1 times as many in rural areas, 1.8 times as many in suburban areas, and 1.7 times as many in urban areas, where the roll out of wireless broadband was most rapid over this period). Exhibit III-2 shows an estimate of the implications of offloading traffic by estimating the number of cell sites that would have been necessary to adequately provision the network. In order to just maintain the historic decline in subscribers per cell site, the cellular providers would have had to add 109,000 additional cell sites. Weighting wireless broadband subscriptions at 1.8 times other subscriptions (the suburban average); they would have had to add 130,000 cell sites.[76]

---

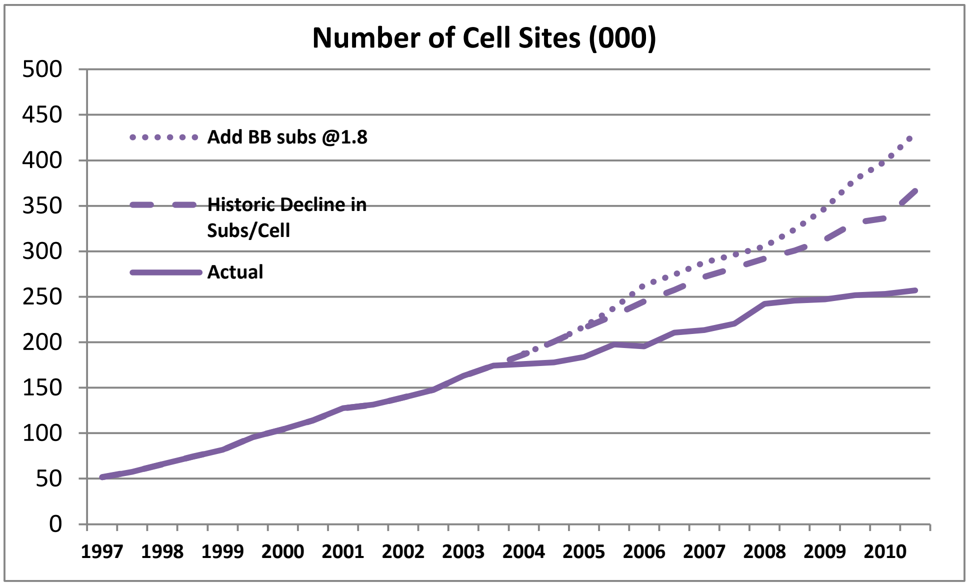
[73] Cooper, 2011, before 2004 there were very few mobile broadband subscribers and by 2008 AT&T, which had exclusive distribution of iPhones, was engaging in substantial offloading, It can be argued that a successful mobile sector required either many more cell sites or offloading of traffic onto unlicensed spectrum. The continued growth of mobile broadband appear to require both, given the amount of traffic that subscribers generate.

[74]

[75] Leigh, 2011.

[76] A study by Dineen (2009)for HSBC suggests a similar level of need for additional cell sites, absent offloading. He constructed three scenarios. In the base case, without increasing cell density, the industry has a shortfall of capacity by 2012. The network is overwhelmed by the combination of more data subscribers and higher rates of data usage per subscriber. In the increasing cell density scenario, the industry is just barely able to keep up with demand until 2015 by increasing cell density by 35 percent. In the third scenario, he assumes both increasing cell density and 20% offload of traffic on unlicensed spectrum. The industry has more than adequate capacity. Dineen's analysis underestimated the growth of wireless data users by 50 percent. By 2011 cellular wireless broadband providers were already offloading almost 40 percent of their traffic. The network was under more pressure than Dineen projected, nevertheless his analysis provides insight into the number of cell sites that would be needed. Using the higher growth rate of data subscribers, but the same data usage rates, without offloading, the network would fall into deficit in 2010-2011 and 2011 usage already exceeds 2012 levels. The projected increases of cell densities in 2011 (23%) and 2012 (27%) needed to keep up with demand imply increases in the number of cell sites of 127,000 and 136,000 respectively. The earlier estimate of 130,000 cell sites seems reasonable.

EXHIBIT III-2:
UNLICENSED USE ENABLES EFFICIENCY IN WIRELESS DATA SERVICE: REDUCTION IN THE NUMBER OF CELL SITES NEEDED



Carriers have avoided constructing 130,000 cell sites

Notes and Sources:

130,000 cell sites derived by using capacity needed for a voice and data subscriber at 1.8 times the need for a voice-only subscriber based on the suburban estimate of Ryan Hallahan and Jon M. Peha, *Quantifying the Cost of a Nationwide Broadband Public Safety Network,* Carnegie Mellon University, Research Showcase, September 1, 2008. Richard Dineen, *The Capacity Crunch: What Can Mobile Telecoms Operators do as "Moore's Law Mobile" Breaks Down?* HSBC, December 8, 2009, estimates increases in cell density necessary to keep up with data traffic growth showing a deficit, without offloading by 2011. The rate of growth of broadband subscriptions exceeds his assumed growth by 50 percent. His projected increase in cell density needed to keep up for 2011(23%) and 2012 (27%) without offloading imply the need for 127,000 to 136,000 more cells.

Adding 130,000 cell sites to a network that previously spent 20 years to reach 256,000 sites would have been an immense challenge. It implies adding about twice as many cell sites in a shorter period than the industry had ever achieved. In Exhibit III-2, the rate of increase in cell sites needed to keep pace with demand after 2008 is greater than anything that had been achieved in the previous decade. It is safe to say that without offloading, the industry would have been smaller and service would have cost much more.

While one can debate how to count the broadband subscribers and how to price the cell sites, the exhibit makes it quite clear that the deployment of cell sites slowed dramatically in late 2008. In the ten quarters between December 2008 and June 2011, the industry added 15,000 cell sites. In the ten quarters before December 2008, the industry added 64,000 cell sites – over four times as many. The drop-off in the addition of cell sites coincided with the offloading of traffic onto the unlicensed use spectrum.

IV. ECONOMIC VALUE

As we have seen, it is difficult to pin down the number of users and the amount of usage in the unlicensed space because of the complementarity of the uses of unlicensed spectrum and licensed as well as wireline broadband and the lack of attention to the usage of unlicensed spectrum. In the two previous sections we have presented best estimates of the economic performance of the unlicensed space in terms of physical quantities. Valuing that activity poses another layer of challenges and complexity. In this section we offer estimates of value based on the estimates of physical quantities. We take a similar approach to the estimation of value, finding real world referents for the value of the activities.

DEMAND -SIDE

Cellular providers bundle and manage access to unlicensed use bands in their wireless broadband offering so the value of access to exclusive licensed and unlicensed use spectrum is comingled. However, several of the major cellular service providers and some independent companies sell Wi-Fi access on a standalone basis. Monthly subscriptions run in the range of $10 to $20.[77] A single month can be as high as $50.[78] Daily fees at hotels, where Wi-Fi is not free, run $10.[79] Session charges are in the range of $2 to $8.[80] Cellular providers sell the ability set up private hot spots for $15 to $30 per month. [81] Given that the price of a broadband data plan for a cellular wireless service is in the range of $20 to $50 per month and access to unlicensed spectrum is bundled in that price, these offerings suggest that the value of access to exclusive licensed and unlicensed use service is similar. At $20/month with 110 million users, the value would be over $26 billion per year.[82]

These estimates do not include hot spot activities, whose value could be substantial. For example, AT&T reported hot spot connections at an annual rate of about 1.2 billion in late 2011. While AT&T has been the most aggressive in using Wi-Fi for offloading, it only accounts for a fraction of the total traffic to hot spots, since so much hot spot traffic involves "unbilled" access in commercial establishments and community applications. Thus, AT&T's one-third share of broadband wireless subscribers probably overestimates its share of hotspot connections. With per session charges in the range of $2 to $4, it would be extremely conservative to put the value of hot spot connectivity at $10 billion per year and growing.[83]

AT&T and Verizon, the two largest retailers of wireless broadband service report that their wireless data revenues nearly doubled between 2008 and 2010, from $21 billion to $38 billion.[84] Since they represent about 70 percent of total mobile data traffic,[85] it is reasonable to put wireless data revenue at $55 billion.[86] Assuming 37 percent of the traffic is offloaded, this would suggest

[77] Web site visits to Boingo, AT&T, and T-Mobile.

[78]

[79]

[80]

[81] Nadel, "2011. "The Big Three national networks charge between $15 and $30 a month (on top of your data place fees) for allowing you to tether a notebook or tablet to you phone. Mobile hot spot technologies can access both exclusive licensed and shared use bands.

[82] An average of $20/month would reflect a combination of monthly subscription values at $10-$20, single monthly buys(up to $50/month) daily buys at $10 and session buys in the range of $2-$8.

[83] The calculation is as follows: ATT count of 1.2 billion times 3 = 3.6 billion connections at average value per session of $3 ($2+$4/2) = $10.8 billion.

[84] Based on 2010 annual reports.

[85] FCC. 15th Annual Report on CMRS

[86] Higinbotham, 2011a.

that offloading is carrying traffic that results in revenues of about $20 billion. This amount will grow dramatically in the years ahead. Recent predictions of a flood of video traffic moving onto wireless networks also predicts that Wi-Fi traffic will equal fixed Internet traffic and account for three times as much traffic as cellular licensed wireless Internet traffic in half a decade.[87] Milgrom, et al. use a similar estimate of the total value of data traffic, but attributes 50 percent to unlicensed use for a value of $25 billion.[88]

The estimate of the value to mass-market users is generally embedded in billed services and not actually billed on a stand-alone basis.[89] They are grounded in quantities and revenue flows that are observable in the marketplace for a small set of end-uses (defined by broadband connections). They indicate unlicensed use generates as much value as exclusive licensed. Others have attempted to estimate more aggregate measures of value or consumer welfare.

Thanki (2009) estimated the consumer surplus associated with in-home Wi-Fi was between $4.3 and $12.7 billion. The estimate rests on the assumption that there were 38 million Wi-Fi users in the United States. The range of values results from a low end assumption that Wi-Fi accounts for 10% of the value of broadband, while the high end results from the assumption that 30% of the value of broadband results from Wi-Fi. The per monthly value is in the range of $9.50 and $27.60, which is in the range of the charges for standalone Wi-Fi. The 30% figure is consistent with the offloading of traffic. Thanki pointed out that he expected those figures to rise dramatically by 2014, perhaps increasing six-fold, if the increase in the number of devices was taken into account. Moreover, there are many other activities that end users engage in. [90]

In fact, in just two years, the number of Wi-Fi users has increased dramatically and is already about three times as high as when Thanki made his estimate. The earlier estimate of 110 million is close to three times the figure used by Thanki and the offloading of traffic has grown dramatically since his estimate as well. With three times as many subscribers, a range of values based on Thanki's per user estimates would now be $13 billion to $38 billion. Moreover, given the increase in traffic since Thanki's estimate and the increase in offloading, it is likely that his estimate that Wi-Fi accounts for 30% of the total value of broadband is a quite conservative estimate for today. Thus, the $38 billion figure is a conservative estimate for the current market. With offloading at 37%, the value would be $74 billion. This is a consumer value figure for total in home Wi-Fi usage. Some of it is explicitly bundled in broadband packages; much of it is not billed.

Thanki also provided two examples of the value of intermediate inputs – intensive wireless communications in hospitals that rely on unlicensed use spectrum and the use of RFID chips in the retail clothing sector. These two are forward looking analyses that are examples of the possible application of unlicensed spectrum technologies. He estimates costs savings in the range of $12 to $24 billion. Many other sectors could achieve similar savings. Benkler (2011) discusses the activity in this space in terms of market shares, not the value of output, but his discussion suggests that the

---

[87] Roetgers, 2011; FCC, 2010

[88] Milgrom, et al., 2011.

[89]

[90] Thanki 2009, p. 27, "This analysis only accounts for the value that consumers might place on the ability to use broadband wirelessly. However, there are a number of other uses for a home Wi-Fi network. These include online gaming using consoles, the ability to stream rich media content and large files around the home and increasingly that of home automation and smart metering applications. Furthermore, many of the applications increasingly being downloaded and used on smartphones are restricted for use only over Wi-Fi networks, so as not to overburden cellular carriers' 3G data networks. Therefore these results are likely to represent a strict lower bound for the value of Wi-Fi in homes. This analysis also does not capture a more structural effect, that the shift of the PC market towards laptops and the convenience they bring has also been facilitated by the availability of Wi-Fi."

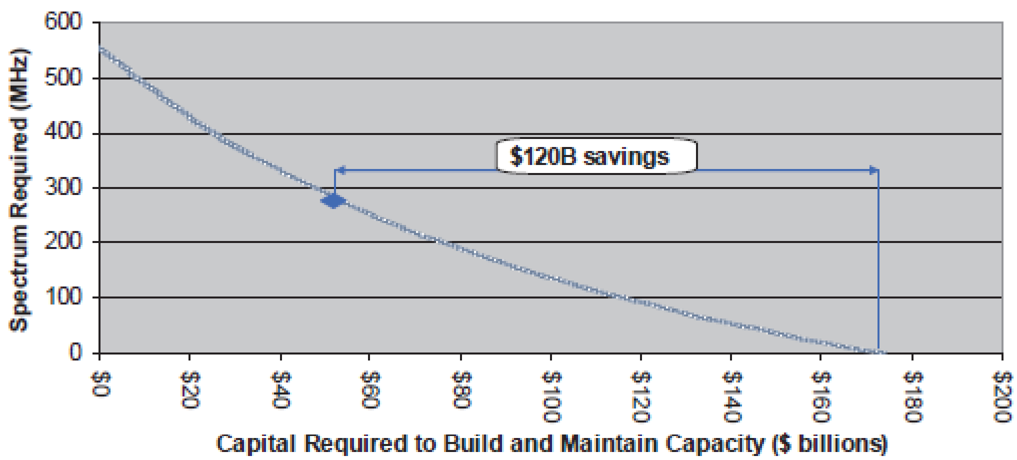
activity in many areas is as robust as it is in the two discussed by Thanki. Thus, the $24 billion is a low estimate of economy-wide value.

SUPPLY-SIDE: VALUING THE EFFICIENCY GAINS

Valuing the efficiency gains discussed above requires us to put a price tag on 130,000 cell sites that were avoided by offloading. The FCC has recently provided a framework with which to do so. In assessing the prospects for provisioning cellular networks to meet future demand for wireless broadband service, it hypothesized an indifference curve between capital investment and spectrum. Cellular providers could add capital – i.e. increase the number of cell sites – or use more spectrum and fewer sites. The FCC analysis describes the implications of Exhibit IV-1 as follows:

> The blue diamond represents the point on the indifference curve corresponding to the … site growth assumption… This represents capital investment by the mobile broadband industry of $54 billion in addition to the 275 MHz of additional spectrum. The curve implies that if no additional spectrum is released, the cost to build enough capacity sites to handle the demand will be $174 billion. The difference between these costs represents the value created by additional spectrum in 2014, which is $120 billion. [91]

Exhibit IV-1: Capital vs. Spectrum Indifference Curve - 2014



Source: Federal Communications Commission, *Mobile Broadband: The Benefits of Additional Spectrum,* OBI Technical Paper No. 6.

The exact same logic can be applied to unlicensed use spectrum. To the extent that cellular providers have substituted unlicensed use spectrum for investment in cell cites "these costs saved represents value created" by the use of unlicensed spectrum. The FCC used a cost per cell site of $500,000. This is the same cost used by Hallahan and Pena. While the FCC considered lower costs, a case can be made that the cost of that many cell sites, particularly concentrated in urban areas where traffic is heaviest, is too low. Building sites for a large number of cells (130,000) becomes

[91] The FCC estimates of cell sites needed to meet demand in next half decade assumes the average growth rate of the period of adoption of broadband, but this rate of growth was far too low to support the expansion of traffic, absent the availability of shared use bands.

more and more difficult and expensive to construct, especially in high density urban areas, where they are needed most. [92] Fiber backhaul costs increase, as well.[93]

The capital expenditure for 130,000 cell sites would be $65 billion based on a cost per cell of $500,000. Converting this to an annual charge at a cost recovery factor of 20 percent yields an annual cost of $13 billion. Operating costs would go up as well. These are generally put at 20 percent of capital expenditures.[94] Thus, the 130,000 cell sites would result in annual costs of $26 billion. Moffett (2011) has recently provided estimates of the cost of deploying a Wi-Fi network for an incumbent broadband wireline network operator. He models the incremental cost to a cable company in a large urban area, Cablevision in New York. Scaling Moffet's estimate up to the 120 million homes passed in the U.S., the capital cost would be about $7.5 billion. Using the same cost recovery ratio of 20%, the annual capital recovery would be $1.5 billion. Operating costs scale up to $.5 billion. The order of magnitude cost advantage of Wi-Fi (one-thirteen the cost of adding cells) provides a compelling explanation for the decision to offload so much traffic into the unlicensed spectrum.

There are two take-aways from this exercise. First, there is no doubt that the cellular providers saved a great deal of money by offloading traffic. That cost would have shown up in consumers' bills. Second, as suggested by the efficiency analysis above, the long-term solution to the traffic problem must involve a mix of approaches to first mile provisioning. Just adding more cell sites will not do get the job done. There is not enough space to keep adding cell sites in these numbers in urban areas where the vast majority of end-users reside. Thus, this range of the projected need for cell sites, absent offloading of traffic, big as it is, may be too low. At a minimum, it reinforces the observations offered above that the unlicensed use spectrum must be a core element of the future industry if data transmission is to grow at anywhere near the rate it has in the past, not to mention the extremely high rates that have been projected of the future.

THE VALUE OF UNLICENSED ACTIVITY IN PERSPECTIVE

To put these estimates in perspective, with 84 million subscribers at year-end 2010 paying on average of about $40 per month, the total monthly revenue for wireless broadband would be about $40 billion per year. Since Wi-Fi is bundled, part of its value reflects the value of Wi-Fi access. Moreover, the estimates of value calculated above involve consumer cost, consumer surplus and producer surplus. Therefore, it becomes difficult to compare the values precisely. However, Thanki's observation seems appropriate: "Using only a fraction of the spectrum, the value derived from unlicensed usage may even become comparable to that generated by licensed usage as the number of unlicensed applications continues to proliferate"[95] That prediction has probably already come to pass.

---

[92] Rysavy 2010a, p. 7 Moreover, a critical problem is that in most urban areas, the ability to add additional towers is very limited, either due to the fact that carriers already have reached capacity in terms of the number of cell sites that an area can support from a practical implementation perspective, or because local zoning restrictions make it unrealistic to add sufficient towers to provide relief.

[93] Chapin and Lehr, 2011, p.5, The primary competitive strategy to cope with insufficient spectrum holdings is thus to split cells, which means building new cell sites that infill existing covered areas. This improves the spatial reuse of existing spectrum allocations and increases capacity. Unfortunately this strategy increases infrastructure costs per square kilometer covered. Another effect increasing infrastructure costs is the high backhaul requirements of the base stations for high-grade mobile broadband service. In most markets, fiber optic backhaul is required to provide the envisioned mobile broadband quality of service. Thus there will need to be significant investment in fiber plants supporting the base stations.

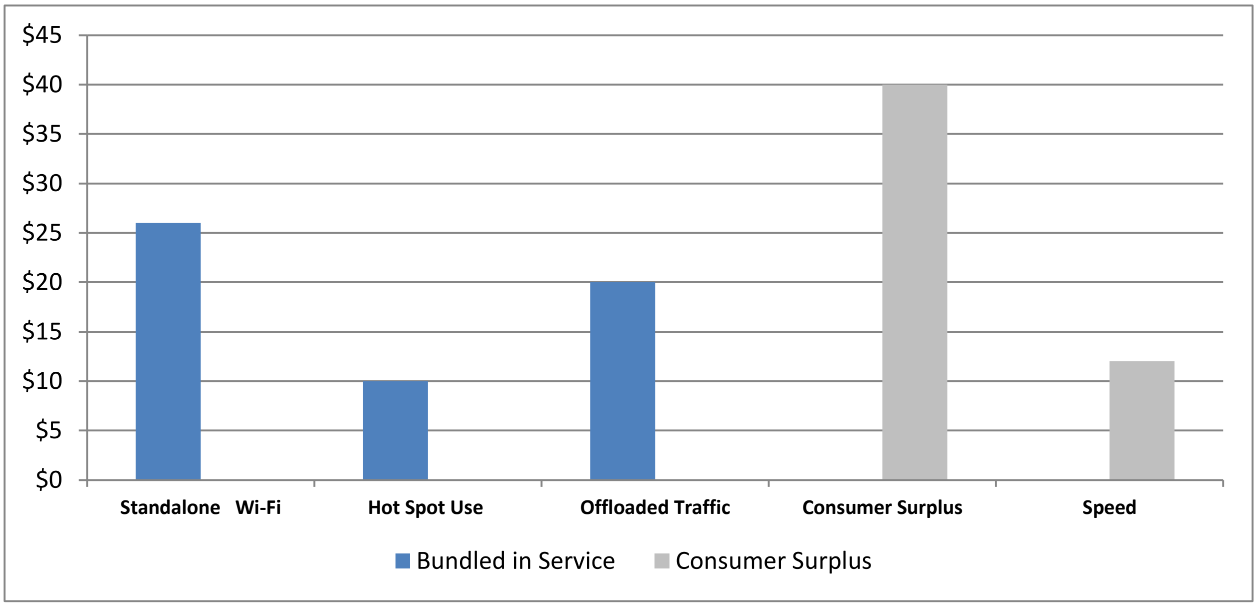
[94] Hallahan and Pena, 2008;.

[95] Thanki, 2009, p. 35.

Exhibit VI-2 depicts this discussion of value in several ways. The top graph provides two estimates of value for end-users. One estimate is based on the value that appears to be bundled in the monthly bills for broadband service. We estimate the value of unlicensed activity by pricing the amount of activity at the level for which it could be purchased on a standalone basis. We show the value of offloaded traffic as 37 percent of the total value of wireless subscription, which is the minimum estimate of offloading. The second set of estimates in the top graph is consumer surplus

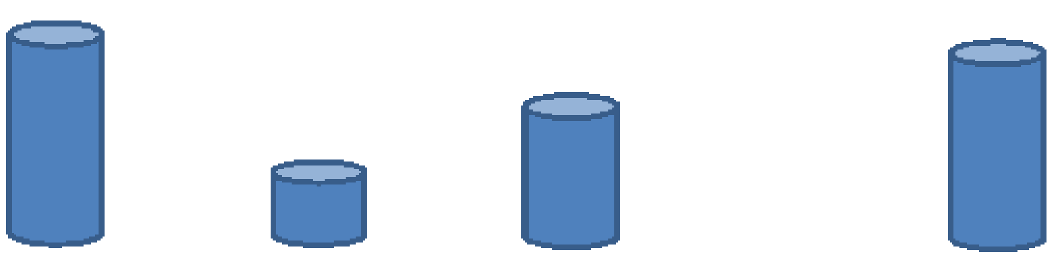
EXHIBIT IV-2: ANNUAL VALUE OF ACTIVITY IN UNLICENSED SPECTRUM (YEAR-END 2010: BILLION)

Mass Market, End-User Value and Surplus



Across Services and Functionalities

Mass Market, End-User Services		Intermediate Inputs		
Extending wireless & wireline broadband to mobile devices	Hotspot Service Public-free Public-billed Community Personal	Cellular broadband traffic offloading	Intensive intra-firm communication Healthcare Monitoring Surveillance Pay & Go	Internet of things Smart Grid Inventory
$26 billion	$10 billion	$20 billion	$24 billion	



Sources and Notes: Wi-Fi standalone value is calculated as 110 million users are $20 per month value based on charges for standalone Wi-Fi services (as advertised in web sites of Boingo, AT&T, T-Mobile). Most cellular providers bundle Wi-Fi with cellular broadband subscriptions. Hot Spot Connectivity estimated by scaling up AT&T 1.2 billion per year to 3.6 national total valued at average per session charge of $3. Consumer surplus is from Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum,* Perspective, 2009 (adjusting his 30% scenario for the current level of broadband subscribers). Speed is from, Paul Milgrom, Jonathan Levin and Assaf Eilat, *The Case for Unlicensed Spectrum,* October 12, 2011). Intermediate Inputs from Richard Thanki, *The Economic Value Generated by Current And Future Allocations of Unlicensed Spectrum,* Perspective, 2009 and Yochai Benkler, *Unlicensed Wireless vs. Licensed Spectrum: Evidence from Market Adoption,* 2011.

There is certainly overlap between the estimates and the consumer surplus numbers include a significant amount of value that is not reflected in the purchase prices of the underlying services. Nevertheless, a figure of $50 billion per year in 2010 seems reasonable for the value of activity in the unlicensed spectrum and that figure is likely to grow dramatically in the near term, as more data flows.

A figure of $50 billion, based on the price/use of services would give unlicensed spectrum a major role in the broadband data space. Monthly charges for wireline broadband average slightly less than $50 per month. In other words, monthly subscription charges for both wireline and wireless total is somewhat less than $100 billion. Since unlicensed adds value to both of those underlying services by extending them to mobile devices, as well as creating unique value in other services, one could conclude that unlicensed is at least an equal partner in the overall value of the broadband data space.

V. INNOVATION

In order to deliver all the services discussed above and carry the immense amount of traffic that has been offloaded onto unlicensed use bands, a great deal of technology had to be developed and deployed in a short period of time. This goes to a fundamental focus of economic policy – the ability of a model to stimulate innovation. There has been an intense debate over which model, licensed or unlicensed, is better at innovation for over a decade. Measuring innovativeness is at least as challenging as measuring the value of economic activity in a space where no centralized organization is charging for it, but it can be done by comparing what innovations have taken place and how significant they are.

In fact, Faulhaber and Faber, two vigorous opponents of the unlicensed use model, have argued that the exclusive licensed model fosters innovation, arguing as follows:

> In spite of this scarcity of spectrum, carriers have been able to utilize this resource with ever-increasing efficiency to offer more voice services and more recently data service over mobile phones.
>
> Innovation in the core network therefore can be conceived as *increasing spectral efficiency.* Increased spectral efficiency is manifest as increased capacity to make voice calls and increased speeds by which our phones access the Internet, download our e-mail and allow us to watch video on our handsets, based on the very limited resources of spectrum.
>
> Innovation in core networks often takes the form of standard-setting, as new means of using the carrier's spectrum must be accompanied by new devices, and device manufacturers must have standards to which they build their handsets or else they won't work on the network. Therefore, we often see core network innovation manifest in an alphabet soup of protocol initials: CDMA, GSM, WiMax, 3G, 4G, EV-DO Rev A, HSPDA, UMTS, and LTE, to name a few.[96]

STANDARDS AND DEVICES

The authors then present a table including technologies that enhance "System Spectral Efficiency of Selected Network Standards" sourced from Wikipedia. As shown in Exhibit V-1, it is an impressive list. However, Wikipedia also provides a list of standards developed for the unlicensed use model under the 802.11 protocol. It is just as impressive, if not more so.

The authors also identify the development and sale of devices as an indicator of innovativeness, listing two dozen that have been deployed. The list involves more adoption than innovation, mostly individual examples of existing technology adopted by a series of companies. Most of the devices were dual mode, so that to the extent it tells us something about innovation, it provides evidence that both models work.

Devices are the focal point of the unlicensed use model as implemented by the FCC, so we should expect it to have a large advantage in this measure of output. Exhibit V-1 reinforces the conclusion that the unlicensed use model stimulates at least as much innovation in the device space. Devices were discussed above in terms of certification and an overall count in the United States. The Wi-Fi Alliance lists thousands of devices available from hundreds of companies in a dozen different categories. While some of the larger manufacturers produce devices for both the unlicensed use and the exclusive licensed space, there are hundreds of smaller companies that

[96] Faulhaber and Farber, 2009, p. xx.

serve only the unlicensed use market. [97] The categories of devices in the unlicensed column represent hundreds of companies and thousands of devices.

EXHIBIT V-1:
INNOVATION IN UNLICENSED USE AND EXCLUSIVE LICENSED USE SPECTRUM: STANDARDS AND DEVICES

EXCLUSIVE LICENSED USE

Standards Released

2G – GSM 1993

2.75G- GSM+EDGE
3G – CDMA 2000
3G – 1x EV-DO Rev A
3G- WCDMA
3.5g – HSPDA
WiMAX – IEEE 802.16
4G – LTE

UNLICENSED USE

IEEE 802.11-1997: WLAN standard originally 1 Mbit/s and 2 Mbit/s, 2.4 GHz RF and infrared (IR) standard (1997),
IEEE 802.11a: 54 Mbit/s, 5 GHz standard (1999
IEEE 802.11b: Enhancements to 802.11 to support 5.5 and 11 Mbit/s (1999)
IEEE 802.11c: Bridge operation procedures; included in the IEEE 802.1D (2001)
IEEE 802.11d: International (country-to-country) roaming extensions (2001)
IEEE 802.11e: Enhancements: QOS, including packet bursting (2005)
IEEE 802.11g: 54 Mbit/s, 2.4 GHz standard (backwards compatible with b) (2003)
IEEE 8702.11h Spectrum Managed 802.11a (5 GHz), European compatibility (2004)
IEEE 802.11i: Enhanced security (2004)
IEEE 802.11j: Extensions for Japan (2004)
IEEE 802.11k: Radio resource measurement enhancements (2008)
IEEE 802.11n: Higher throughput improvements using MIMO
IEEE 802.11r: Fast BSS transition (FT) (2008)
IEEE 802.11w: Protected Management Frames (September 2009)
IEEE 802.11y: 3650–3700 MHz Operation in the U.S. (2008)

Major Handsets Launched

6/29/07 AT&T Apple iPhone
11/19/07 VZW LG Voyager
4/1/08 Sprint SamsungInstinct
7/10/08 Apple iPhone 3G
7/11/08 AT&T HSDPA iPhone 3G
9/23/08 T-Mobile Android G1
10/21/08 AT&T Samsung Epix
11/4/08 AT&T Blackberry Bold
11/20/08 Sprint HTC Touch Diamond
11/21/08 VZW Blackberry Storm
2/24/09 AT&T Matrix Pro
2/26/09 VZW LG Versa
3/2/09 Sprint Palm Pre
4/1/09 MetroPCS Samsung Finesse
7/13/09 VZW & Sprint Blackberry Tour
9/21/09 Cellular South HTC Hero (Android)
EOY 2009 LG Watch Phone

Sources:
Gerald R. Faulhaber and David J. Farber, *Innovation in the Wireless Ecosystem: A Customer-Centric Framework* (2009) for exclusive license standards major handset launches; Wi-Fi Alliance, Wi-Fi Certified Products, http://www.wi-fi.org/certified_products.php for Wi-Fi-enabled devices

Examples of Certified Wi-Fi-Enabled Devices: (Hundreds of companies/Thousands of Devices)

Networking Equipment - Access Point/Router
Access Point for Home or Small Office (Wireless Router) Enterprise Access Point, Switch/Controller or Router Mobile AP
Networking Equipment - Gateway
Cable, DSL or Other Broadband Gateway (Integrated Home Access Device)
Consumer Electronics - Cameras
Digital Still, Portable Video, Networked Web
Consumer Electronics - Audio Devices
Digital Audio - Stationary (speakers, receiver, MP3 player)
Digital Audio - Portable (MP3 player)
Consumer Electronics - Video Devices
Set Top Box, Media Extender, Media Server
Display Device (eg. television, monitor, picture frame)
Consumer Electronics - Gaming Devices
Game Console or Game Console Adapter
Gaming Device - Portable
Consumer Electronics - Storage and Servers
Media Server or Media Adapter
Network Storage Device (networked hard drive)
PCs and Computing Devices - Adapter Cards
External, Internal Wi-Fi Adapter Card
PCs and Computing Devices - Computers and PDAs
Laptop Computer, Ultra-mobile PC, PDA
PCs and Computing Devices - Printers
Printer or Print Server (includes scanner and fax)
Voice-Capable Devices - Phones
Phone, dual-mode (Wi-Fi and cellular)
Phone, single-mode (Wi-Fi only)
Smartphone, dual-mode (Wi-Fi and cellular)
Smartphone, single-mode (Wi-Fi only)
Other
Barcode Scanner

[97] Wi-fi alliance, web site.

NETWORK TECHNOLOGIES AND APPLICATIONS

Faulhaber and Faber also list a series of announcements of roll outs of technologies by individual carriers. One-third of the listed "innovations" are announcements about technology that will be adopted, rather than actual adoption or innovations. There are fifteen entries but only four technologies. These are simply the standards listed in Exhibit III-3 being deployed by cellular carriers.

A systematic comparative look at network technologies and applications reinforces the conclusion that the unlicensed model has performed at least as well as, likely better than, the licensed model (as shown in Exhibit V-2). Thanki provides a comparative analysis of the timing of major technology deployments and introduction of applications Once again, it is clear that the unlicensed use model is at least as effective as the exclusive licensed model. Thanki defines the innovations in applications as follows:

> Incremental innovation involves small steps, something that is a minor improvement to an existing solution. Small steps have taken Gillette from one razor blade, to two, three and now five glades.
>
> Radical innovations take big steps, creating major improvements that are often very different to existing solutions. Cloning 'Dolly" the sheep qualifies as a radical innovation – it was a first and it was certainly a breakthrough.
>
> Revolutions happen when groups of these innovations can together cause a huge, far-reaching impact. The computing revolution was achieved because of thousands of new technologies including the microprocessor, the telephone and the television. Globalisation, the Human Genome Project, and the Lunar Landing would not have been possible without it.[98]

EXHIBIT V-2:
INNOVATION IN UNLICENSED AND EXCLUSIVE LICENSED SPECTRUM: TECHNOLOGIES AND APPLICATIONS

	EXCLUSIVE LICENSED USE	UNLICENSED USE
Network Technologies		
Digital Spread Encoding	1991	1988
Spread Spectrum	1995	1988
OFDM	2006	2001
MIMO/Adaptive Beamforming	2008	2004
Applications:		
Radical	Precise global positioning	Precise urban positioning Real-time location
	Wide area networks	Local area networks/wireless broadband
	Satellite based Communications	Novel wireless connectivity (critical device monitoring, monitoring and control in adverse environments)
		Automatic building control Wireless sensor networks
Incremental	Mobile TV	Personal area networks/Cable replacement (computer mice, keyboards, printers, head sets, headphones
	Services, texting, picture messaging, video calling, secure mail	Contactless payment Supply chain improvement
	Data over broadcast	Consumer electronics (Wi-Fi radio, STBs
	Networks (subtitling & video text)	Identification (RFID - Humans, Animals, Goods) Remote controls

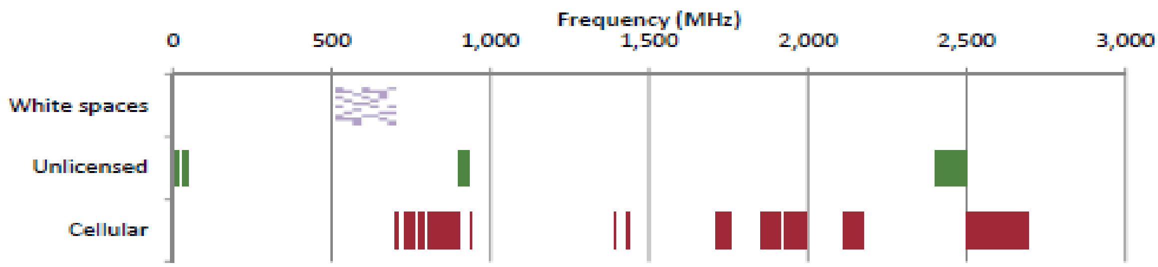
[98] Thanki, 2009, p. 38.

Sources:
Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum,* Perspective, 2009, pp. 37-39).

MAKING THE MOST OF SCARE SPECTRUM RESOURCES

Interestingly, Faulhaber and Faber point out that the cellular industry has achieved its success "in spite of a scarcity of spectrum."[99] Compared to the amount of spectrum used by broadcasters that complaint rings true. However, compared to the amount of spectrum set aside for unlicensed use, it does not, certainly not with respect to high-quality spectrum. Exhibit V-3 shows the relatively small amount of spectrum in the 500 MHz to 1 GHz range set aside for unlicensed use. Even up to 3 GHz, the challenge of "spectrum scarcity" has been much greater for the unlicensed use model than the exclusive licensed model.

EXHIBIT V-3:
COMPARISON OF SPECTRUM AVAILABLE FOR LICENSES AND UNLICENSED BELOW 3 GHZ



Source: Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum,* Perspective, 2009, pp. 37-39).

The opportunity to share white spaces is depicted differently in the graph because the users who will share the white space do not occupy the entire broadcast spectrum. The sharing users are required to give deference to the licensees and in major metropolitan areas, they may be limited to just a couple channels. Moreover, even this limited opportunity is very much at risk based on proposals pending in Congress.

The paucity of spectrum made available for wireless, communications, particularly unlicensed use, has become a potentially critical constraint on future expansion of activity and the ability of the economy to generate trillions of dollars of value discussed in Section IV.

Thanki's description of the success of unlicensed underscores the dramatic difference in the success of unlicensed, given the immense amount of activity taking place in "narrow slivers" of spectrum.

> [W]e saw the wide uses to which unlicensed applications are being put in the consumer, commercial, industrial, educational, healthcare and governmental sectors. In each of these sectors there are thousands of equipment manufacturers and system integrators creating new products and services, and thousands of buyers exploring new ways in which they can use wireless devices. This market interplay is the origin of the innovations in unlicensed spectrum…

99

This level has been achieved in a short-time scale. It has been less than 25 years since the FCC permitted the use of communications devices in unlicensed ISM spectrum. Furthermore, this innovation has taken place in a limited amount of spectrum…. The substantial levels of economic benefit and innovation that are delivered by unlicensed usage of spectrum… has been largely achieved using narrow slivers of low frequency spectrum, or larger allocations of higher frequency spectrum. However, there is no larger allocation of spectrum for unlicensed usage between 100MHz and 1GHz, spectrum which has excellent characteristics in its ability to carry broadband data and in its ability to penetrate walls and other obstacles using low transmit power. This may have adversely affected the development of longer-range, more reliable and ultra-low power unlicensed applications requiring high data rates[100].

[100] Thanki, 2009, p.44.

VI. FUTURE PROSPECTS AND CHALLENGES

THE POTENTIAL VALUE OF FUTURE MOBILE COMMUNICATIONS

Given that there is a substantial potential increase in penetration of mobile broadband and numerous applications that have only begun to penetrate the marketplace, there would appear to be a great deal of potential expansion in the sector. In fact, there is a broad consensus that the potential value is immense.

Consider the view of a group of broadcasters, led by Sinclair, a broadcaster that probably holds more exclusive licenses to high-quality spectrum than any single commercial entity. Their proposal implicitly admitted that TV broadcasting is an inferior use of the spectrum.[101] They estimated that repurposing the spectrum could result in additional economic activity of more than one trillion dollars over a 15-year period.[102] They want the federal government to allow them to take on the role of landlord. They will rent the spectrum out to other users and pass a small fee – 5 percent – back to the government.[103]

Advocates of auctioning spectrum for exclusive licenses argue that auctioning 120 MHz of high-quality spectrum would generate about $40 billion.[104] They also argue that the value spectrum yields to exclusive licensees is 10 to 20 times larger than the price they will pay for it at auction. This suggests value to the cellular carriers of $400 to $800 billion. The FCC wants to make 2.5 times that amount of spectrum available, which suggests potential value in the range of 1 to 2 trillion dollars. This estimate of the value of spectrum in excess of the price it would fetch in auction is corroborated by another calculation that these authors make, one which provides into the current policy context. The high quality spectrum that is the target of the current bandwidth frenzy of the cellular providers is all subject to broadcast licensing. Current proposals to auction that spectrum envision paying the broadcasters to move their signals. By using new technologies that are more efficient in the use of spectrum, they can deliver the same service with less spectrum, which will free up spectrum for repurposing. The economic cost of moving the TV broadcasters is put at $1 billion.[105] The transaction cost of getting the broadcasters to agree to move, to buy out their licenses, is put at $15 billion.

Europe has witnessed an interesting debate over how to capture the potential value of high quality spectrum. Two equipment manufacturers (who expect to sell a lot of network equipment) have argued to EU regulators that allowing exclusive licensees to manage the sharing of their spectrum (which they call Authorized Shared Access) would increase the output of the spectrum by over $100 billion per year.[106] Over a 15-year period, the value would be just over $1.5 trillion. Advocates of unlicensed have countered by proposing two new approaches to utilizing the

[101] Miller, 2011.

[102] The initial estimate indicated a stream of value of about $2.5 trillion over 15 years. The estimate was later cut in half for political reasons (Miller, 2011, Jessell, 2011). The plan was prepared by Rajiv, 2011.

[103] Whether they should be the trustees of this value and play the landlord role is unclear, to say the least. Broadcasters have no particular organizational competence to perform the role of wireless landlord. They do not develop, deploy or manage two way communications technology, not to mention manage a complex space with multiple technologies. If anything, they have been thoroughly hostile to the sharing of spectrum and their resistance to change has delayed the availability of high-quality spectrum for decades. The have a conflict of interest, since they have a financial interest in an incumbent line of business that they would want to protect. They do not have a direct customer relationship; they sell advertising not subscriptions or service. They did not acquire the spectrum in the marketplace – they were given the spectrum in beauty contests. Their only claim to being the rent collectors is that they are the incumbent tenants, who occupy the space rent free.

[104] Bazelon and Jackson, 2011.

[105] Bazelon and Jackson, 2011, p.).

[106] Qualcomm, Nokia, 2011. Similar arguments have been made in the U.S. without the estimation of value. .

broadcast spectrum –make more spectrum available to unlicensed spectrum through sharing (along the white spaces model, which has been authorized, but not yet implemented) and dedicate 50 MHz of cleared spectrum entirely for unlicensed use.[107] The unlicensed advocates estimate that the value created by dedicating high quality spectrum to unlicensed would be over $110 billion per year. This argument puts the value of spectrum close to $1.7 trillion over a 15-year period. They appear to put the value of increasing additional spectrum for exclusive licensed at slightly less than half of what Qualcomm and Nokia do. [108] Therefore, in their view unlicensed spectrum will generation twice the value that exclusive licensed spectrum will. This is consistent with the earlier analysis.

It is safe to say that the stakes are huge.

THE CHALLENGE OF PROVISIONING THE WIRELESS FUTURE

The challenge ahead lies in making the most efficient use of spectrum –carrying as much data as possible, maintaining quality of service, and making such service affordable. The challenge involves both the continuing growth in the quantity of data and a dramatic increase in the variety of data and consequent need for different quality of service.

Growing Diversity of Service Needs

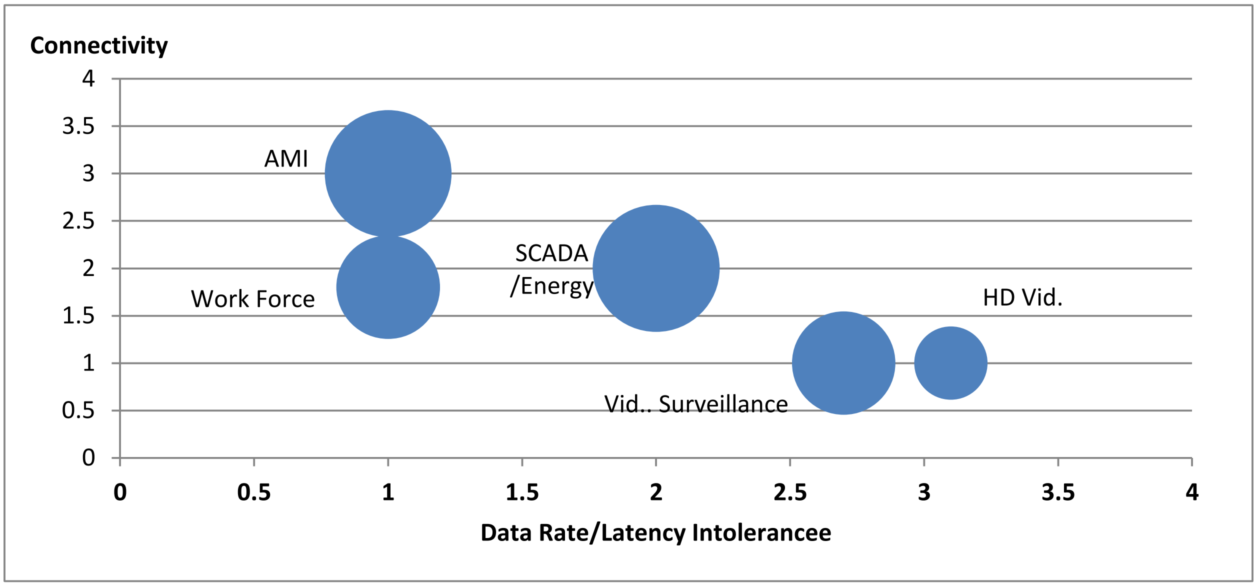
The challenge of delivering wireless data as usage expands will be made more complex by the fact that different types of communications place different demands on the network. Variety creates complexity. However, it may also alleviate some of the traffic flow problems because different types of communications place less demand on the network. Key conditions that vary across applications identified in the literature involve latency, connectivity, coverage and bandwidth at affordable costs, as shown in Exhibit VI-1. As shown in the top graph, using a simple three point scale (low, medium, high) for three communications characteristics for five broad types of intermediate input services suggests the complexity of the emerging communications space. For example, at one extreme, advanced metering tolerates a low data rate/hi-latency, needs low cost radio technology, and does not need a high level of connectivity. Video applications have the opposite set of requirements. Affordability is defined by the interaction of the cost and value.

The bottom graph reproduces a two dimensional analysis of mass market applications that yields a similar view of the terrain of demand. The bottom graph focuses on mass market applications according to bandwidth needs and congestion tolerance. E-mail and gaming are polar opposites in this categorization.

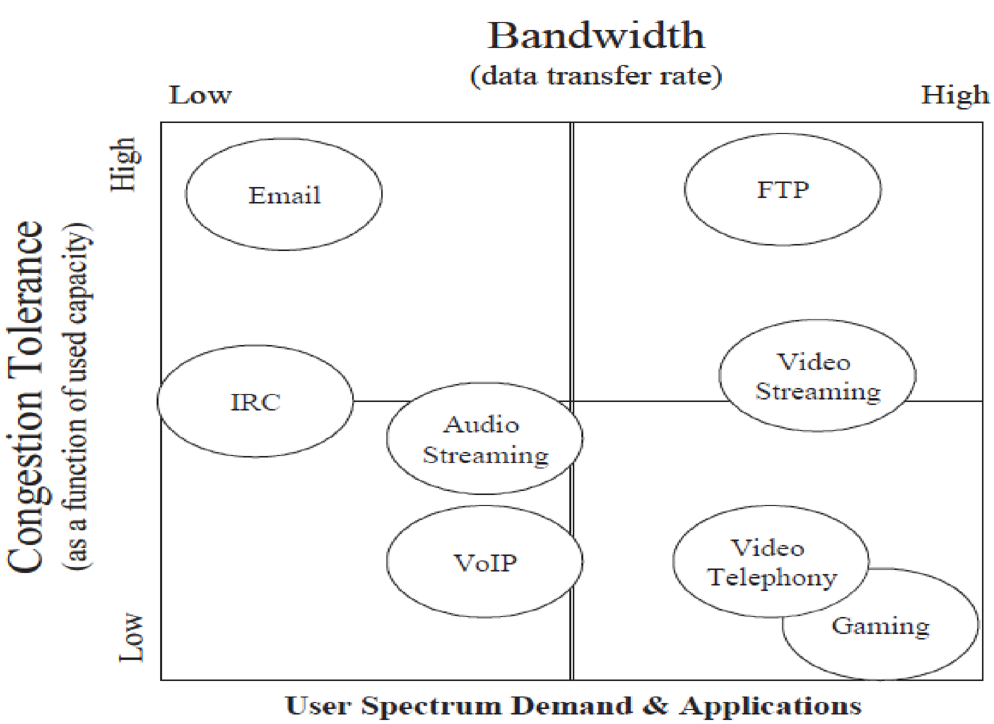
A detailed analysis of the diverse characteristics is not critical to the task of evaluating the future contribution of unlicensed use. The discussions recognize the complexity of the communications ecology that is emerging and that unlicensed use is likely to have a significant role in the future because it is better suited to provide important functionalities to support several of the configurations of demand characteristics. IAs long as spectrum policy does not bias the outcome by favoring one approach at the expense of the other, both would expand to meet growing demand. Moreover, by offering both models the opportunity to expand the amount of activity is likely to be higher and efficiency greater.

[107] Forge, Horvitz and Blackmun, 2011.
[108] Forge, Horvitz and Blackmun, 2011.

EXHIBIT VI-1 TECHNOLOGY AND COST CHALLENGES, RESOURCE AND INSTITUTIONAL SOLUTIONS
(size of circles measures sensitivity to device costs)



Sources: Guzelgoz, et al. emphasize Data Rate/Latency – i.e. low data rate, high tolerance for latency; Chapin and Lehr, 2011, emphasize cost i.e. need for low cost; Benkler, 2011, emphasizes connectivity, i.e. need for Connectivity;



Source: Mark M. Bykowsky, Kenneth Carter, Mark A. Olson and William w. Sharkey, *Enhancing Spectrum's Value Through Market-Informed Congestion Etiquettes,* February 2008.

Enhancing Coverage

Complementarity will be necessary to solve the problem of geographic coverage [109] by evolving new institutions to deal with interference.

- Cellular service providers must shrink cell size, which means moving the base stations closer to consumers. [110] They will not get close enough to deliver the exaflood of data directly to the consumer over their licensed spectrum, however. The amount of data flowing in unlicensed spectrum is likely to rise.
- Users of unlicensed spectrum will have to find ways to ensure quality of service as their reach expands. The unlicensed use model will have to exercise greater control over interference with rules that place greater limits on what people can do (controlled access or managed commons), or with some limits on the number of users.

Exhibit VI-2 conceptualizes the geographic space of the wireless future. It suggests how access to spectrum in the 500 MHz to 1 GHz range could dramatically improve the performance and expand the scope of the unlicensed use model. Holding power constant and allowing Wi-Fi technology to operate at different frequencies affords it better coverage, or higher capacity. The bulk of end-user activity at present takes place in the 2.4 GHz spectrum and affords it a limited coverage. Use of 5 GHz (and perhaps higher) bands will allow higher capacity that can support new applications or improve the performance of existing applications, but it does not solve the problem of the limited range imposed on the unlicensed use model by its exclusion from higher quality spectrum. Using the TV white spaces[111] example, access to higher quality spectrum[112]

---

[109] Chapin and Lehr, 2011, p. 21, "The move to smaller cell sizes that is driven, in part, by spectrum scarcity, makes infrastructure sharing between dedicated and unlicensed (range restricted) spectrum easier. It is important to note that cell density does not need to increase to the point that unlicensed bands can be used to reach any mobile device. Unlicensed spectrum can be used for mobile devices that are close to the infrastructure antenna, with dedicated CMRS spectrum used to reach mobile devices that are further from the antenna. The cell density merely needs to be reduced to the point that a substantial fraction of mobile users are within range of the unlicensed band from an infrastructure antenna, in order to provide significant offload."

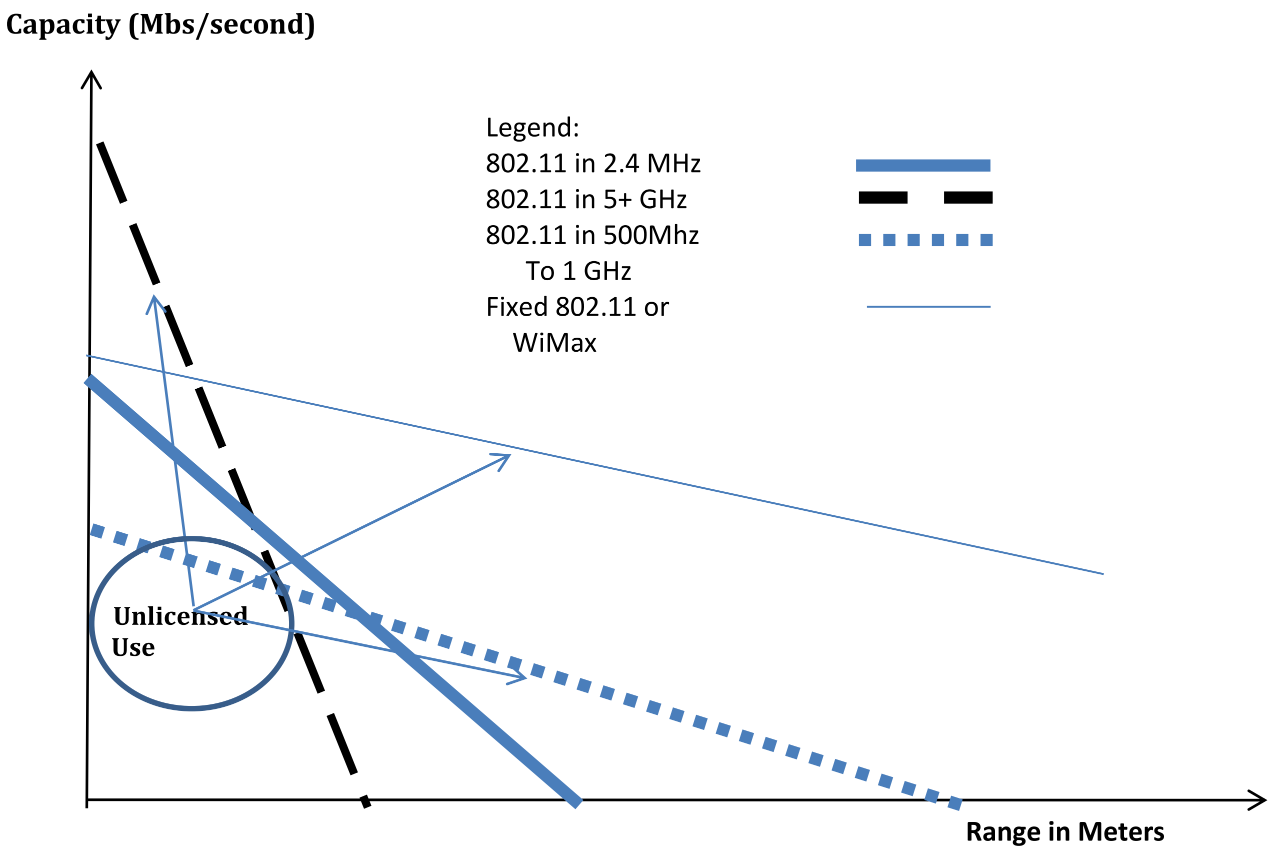
[110] Chapin and Lehr, 2011, p. 32, "A key driver of the need for increased sharing among CMRS operators is the need to shrink cell sizes. Smaller cell sizes enable efficient spatial reuse of spectrum and support lower power operations, as well as a number of other technical options such as network MIMO. Lower power operation has many benefits, including ameliorating concerns about any potential health risks. Moreover, lower power operation facilitates the sharing of spectrum. There are multiple reasons for this, including the fact that it provides better range matching between licensed and unlicensed spectrum and the technology for frequency agility is more advanced and affordable."

[111] Lamberth, 2011," In the U.S. and U.K. TV white spaces occupy positions low on the frequency map meaning that the signals penetrate building better, travel farther and cover larger areas than higher-frequency signals. TV white space transmissions can carry as far as 10km/6.2 miles, which is more than 100 times better than Wi-Fi operating range of 100 feet indoors and 300 feet outdoors. Data throughput rates are in TV white space spectrum are high… Because of these attributes, the U.S. Congress and FCC call TV white spaces "Wi-Fi on steroids" and "super Wi-Fi" (even though white space devices do not conform to IEEEs 802.11 Wi-Fi standard)…. One of the thorniest problems is that white spaces aren't available in the same amount or on the same channels everywhere… Because white space availability is generally better in rural areas, the first white space solutions are to be offered for sale may be skewed toward solutions that benefit these communities, such as pubic broadband services. "

[112] Lamberth, 2011, "TV white spaces are available to anyone on an unlicensed basis, similar to Wi-Fi. That means any device can use the spectrum so long as it complies with a set of rules that prevent it from interfering with licensed users, wireless microphones and other white space devices. These rules present some fairly steep technology requirements: white space devise must function at restricted power levels, use adaptive power control to ensure they are radiating at the lowest level possible, know where they are, and connect to the Internet in order to access a geotagged spectrum availability database. In both the U.S. and U.K., proposed requirements that would require white space devices to sense and avoid other signals on the channels they're using were dropped based on technological feasibility, timing and cost, though both regulators would prefer this approach should it become feasible in the future.

would more than double the coverage.[113] Hotspots could become "Hot Zones or Oases."[114] In areas where the current exclusive licensed frequencies are unused, it would be possible to use more power to increase the capacity and coverage of Wi-Fi in fixed applications. WiMax would operate in this space as well, but it requires greater control of interference, which has given rise to a hybrid, lightly licensed model.[115]

EXHIBIT VI-2:
THE POTENTIAL COVERAGE AND CAPACITY GAINS FROM ACCESS TO HIGHER QUALITY SPECTRUM



Sources:

These estimates are a representation of the general gain in capacity and reach based on Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum*, Perspective, 2009 and Dirk Grunwald, *How New Technologies Can Turn a Spectrum Crisis Into a Spectrum Opportunity,* February 2011. The precise degree to which the range and capacity are increased depends on the amount of spectrum made available and the rules of use.

---

[113] Thanki, 2009, also presents a calculation of the difference that having access to high-quality spectrum would make in increasing the coverage of 802.11g devices. At the power level allowed by the sharing rules, the coverage is tripled by having access to higher quality spectrum. Coverage is much greater in rural areas because of fewer obstacles, but even in urban areas the difference is considerable. Given the high cost of providing rural areas with broadband Internet access, making this spectrum available for shared use would be particularly important in these areas.

[114] Benkler, 2011.

[115] The distinction between unlicensed with stronger rules for preventing interference and lightly –licensed blurs as they meet. Wikipedia defines lightly licensed as follows: "In June 2007 the FCC issued final rules for a novel "light licensing" scheme in the 3650-3700 MHz band.[2] Licensees pay a small fee for a nationwide, non-exclusive license. They then pay an additional nominal fee for each high powered base station that they deploy. Neither the client devices (which may be fixed or mobile), nor their operators require a license, but these devices must receive an enabling signal from a licensed base station before transmitting. All stations must be identifiable in the event they cause interference to incumbent operators in the band. Further, there is a requirement that multiple licensees' devices are given the opportunity to transmit in the same area using a "contention based protocol" when possible. If interference between licensees, or the devices that they have enabled, cannot be mediated by technical means, licensees are required to resolve the dispute between themselves." http://en.wikipedia.org/wiki/IEEE_802.11y-2008.

As coverage expands, interference management becomes more challenging. The solution lies at the institutional level. Expanding range requires additional measures to prevent interference, which can be provided in a number of ways including a mix of known technology and policy,[116] and the innovation that can be expected once the barrier to wider coverage is removed.

The Multiple Roles of Unlicensed Spectrum in the Wireless future

The expansion and nimble integration of unlicensed use technologies with exclusive licensed models has played a key role in the development of broadband data service. It is likely to continue to play a vital part in promoting an efficient solution to the long-run challenge of provisioning mobile data services.[117] Unlicensed use of frequencies is one of the key technologies that provide a platform that makes much more intensive use of spectrum.

> Wi-Fi is becoming increasingly more effective as a broadband access solution for the following reasons: The IEEE 802.11n provides for extremely high throughputs (maximum 6000 Mbps theoretical rate), high spectral efficiency, extended range, multi-band support, and operating flexibility in trading off between distance and throughput. Wi-Fi can be deployed at lower cost than most alternative technologies, especially in environments where little wireline infrastructure exists. Time to market is also faster. Maturing operator-class Wi-Fi equipment has the sophisticated functionality needed to work in these challenging RF environments… New equipment enables flexible deployment. Examples include mesh operation and Wi-Fi based point-to-point communications for backhaul.[118]
>
> Unlike traditional services where dedicated connections are provisioned, broadband services can leverage unlicensed connections that are 'virtualized' according to principles developed for Internet- and Web-based network technologies. Tremendous performance gains and capital efficiencies can be achieved with intelligent scheduling and bandwidth management techniques…
>
> Notable innovations are particularly focused toward enabling low cost platforms for small cells, software defined radio configurations, and automated configuration and provisioning management. Many of these innovations capitalize on technical capabilities derived from the Internet.[119]

The two ownership models can expand to deliver these functionalities along two dimensions –geographic and organizational. While convergence is frequently used to describe this process, convergence has taken on a connation that implies networks inevitably compete and

---

[116] Chapin and Lehr, 2011, p. 7, "Below a threshold cell size, network MIMO techniques become feasible.a/ a/ Most users are familiar with the new class of WiFi routers that use 802.11n MIMO (Multiple Input-Multiple Output) technology. This is implemented on each wireless router by using three antennas to take advantage of multipath to disentangle the desired signal from noise, and thus improve system performance. Similar strategies can be employed by integrating the signals from multiple networked base stations to enable network MIMO, if cell size is small enough that mobiles are in range of multiple base stations at the same time. In addition to expanding capacity, network MIMO provides benefits to reliability (because of path diversity and redundancy), coverage (dead-spot elimination), and data rate. p. 17, "By the term *controlled access unlicensed band* we refer to the general class of unlicensed allocations made in recent years." In the "original" unlicensed bands… an unlicensed device can transmit at any time as long as no interference occurs to protected users…. More recent unlicensed bands preserve the property that any device can use the band without exclusive licenses, but they have placed increasingly strict requirements on unlicensed transmitters. These requirements have been necessary to protect incumbents from interference since the new unlicensed allocations have been carved out of partially used spectrum bands."

[117] Wirelesse2e, 2010, "In summary, choice for the wireless network executive is not a simple bifurcation between spectrum and additional cell-sites." Instead a multi-pronged approach is the advisable path: Deploy the technology advances (spectrum efficiency), Make spectrum purchases to plan for traditional macro, micro cell deployments for dense urban, urban and rural coverage, Identify hotspots (those 3-4% of sites that will carry 30-40% of total network traffic) and find ways to use dense Wi-Fi deployments to off-load traffic, Work with device manufacturers to promote the adoption of higher orders of MIMO for 802.11n and the use of 5 GHz band."

[118] Rysavy, 2010b, p. 10.

[119] Marshall, 2011.

replace one another, but the relationship between licensed and unlicensed use of spectrum entails a great deal of complementarity, co-existence. Complementarity and functional specialization are likely to continue to be central features of the wireless broadband ecology, although competition may increase as well. Networks based primarily on exclusive licenses will continue to perform better by integrating unlicensed spectrum,[120] but services that rely primarily on unlicensed may expand as well. While we have seen and expect future complementarity and functional specialization, we should not dismiss the possibility of rivalry as well. At a minimum, exactly where the line between the services will be drawn is an open question that should be decided in the marketplace, not determined by policies that decide the outcome by allocating spectrum to one model and not another.

A leading Wall Street analyst of the communications space has recently described two possibilities that are emerging in the marketplace that rely on the ubiquity of unlicensed spectrum-based Wi-Fi.[121] For cable operators, he sees the continuing extension of broadband as the driving force behind the adoption, as we have noted above.[122] He also sees the potential for a full purpose wireless service to develop that relies primarily on Wi-Fi. A link to cellular wireless would be maintained for voice, not broadband data. The key factor in this hybrid model is the increasing density of Wi-Fi.

> Earlier this week, we wrote about even more disruptive opportunity made possible by Wi-Fi. A start-up named Republic Wireless is now beta testing an unbelievable $19 per month unlimited plan for voice, video and data. The plan is made possible by the emerging ubiquitous availability of Wi-Fi. Republic's modified LG *OPimus* Android smartphone defaults to WiFi… even for voice service. Importantly, the service *does* include full ("unlimited") cellular capability whenever WiFi *isn't* available (via an MVNO arrangement with Sprint). That positions Republic as a credible replacement for higher priced plans (including, those, ironically, from Sprint). This kind of service would be a natural fit for cable. Inside the home, it would leverage the customer's own WiFi network (that is, their cable broadband connection). At work, it would leverage their employer's network. At malls and restaurants and city centers, it would leverage the Wifi network increasingly being built by Comcast, Time Warner Cable and Cablevision. The customer would only need a traditional cellular network in a car."[123]

Benkler places this potential direction of development into the current policy context, as discussed in the next chapter, by noting that access to higher-quality bands could greatly enhance the ability of the unlicensed model to provide seamless coverage, thereby bringing the superior entrepreneurial and innovative forces of the unlicensed model to bear with greater force on future services.

> [I]f Congress does empower the FCC to move broadcasters so as to make it easier to deploy new uses of wireless technologies, it becomes possible to use that change to permit open wireless devices to transmit in some of the cleared frequencies, rather than auction all of the cleared frequencies for exclusive use. A dedicated band in which only open wireless devices would operate, rather than on a shared basis as with white spaces, would allow the development of devices with longer range and higher power. These would be constrained not by the sensitivity of older, less sophisticated services like broadcast, but only by what new devices specifically built for open

---

[120] Chapin and Lehr, 2011, p.28,"operators who segregate their traffic may be better positioned to take advantage of dedicated unlicensed spectrum to supplement their overall capacity needs. "

[121] Moffet, 2011.

[122] MOffet, 2011, p. 3, "If there is an opening for cable operators in the wireless industry, it is far more likely to be in offering WiFi than in offering LTE… Their strategy is to give away WiFi service for free. They've made wireless a *feature.* The strategy actually makes sense. They rely on free spectrum and low cost WiFi equipment. They leave it to consumers to foot the bill for equipment (i.e. The Wi-Fi chips that are already build into iPhones and iPods and laptops), meaning there's little or no subscribe acquisition costs.

[123] Moffet, 2011, pp. 3-4."

wireless use can bear. The primary potential benefit of such new devices would be increased area coverage, particularly in built environments. By increasing coverage, these devices could make the kinds of nomadic access we already see from open wireless strategies more seamless. In other words, a dedicated band in these lower frequencies could provide precisely the capabilities that could fill in the primary weakness that current open wireless strategies exhibit because of the regulatory constraints that the protection of licensed services imposes on them—continuous coverage. It would allow open wireless strategies to fulfill the requirements of ever-more time- and space-sensitive applications.

More basically, open wireless strategies have exhibited rapid innovation, filling services that only a few years ago would have been considered to require licensed exclusivity. The freedom to operate and innovate, by anyone for any purpose, that permission to operate without a license provides has allowed the kind of distributed, diverse innovation we have come to associate with computers and the Internet, more than the innovation model of more centralized models.[124]

[124] Benkler, 2011, pp. 19-20.

VII. POLICY IMPLICATIONS OF THE SUCCESS OF UNLICENSED SPECTRUM

The past success of the wireless data sector is remarkable and the potential future benefits are bright, but the challenges are great too. The irony is that the wireless sector has been so successful over the past decade that the debate has shifted 180 degrees. It started from a situation in which analysts had to fight to convince policymakers that an immense amount of value was being wasted in spectrum that was locked into static broadcast applications; but we now have arrived at a situation in which there is so much potential use and value that we face a perpetual "spectrum crunch." Traffic growth has been so great and is likely to remain so rapid that there inevitably will be a series of "spectrum crunches," even if more bands are made available to exclusive licenses.[125]

Advocates of both the unlicensed use and exclusive licenses models are busy developing analyses that explain the likely direction and parameters of change. These analyses are intended to demonstrate that, given access to more spectrum, each model can make a major contribution to the expansion of the sector. The lesson that emerges from the analyses is that both models can expand substantially and the mutually beneficial and peaceful coexistence of the two the models should be preserved and enhanced.

THE INGREDIENTS OF SUCCESS

In order to ensure that future policy preserves and promotes the opportunity for the unlicensed model, it is important to identify the factors that have enabled the model to succeed. The success of the unlicensed model rests on two sets of factors – traditional economics and systemic diversity.

From the point of view of traditional economic analysis, compared to exclusive licenses, the unlicensed model is extremely, even radically, deregulatory.[126] It captures what would be externalities with respect to licensed approaches.[127]

- The unlicensed model removes the spectrum barrier to entry, which is the primary obstacle by allowing anyone to transmit signals for any purpose, as long as the devices used abide by the rules.[128]
- Removing this barrier to entry removes the threat of hold up, in which the firm that controls the bottleneck throttles innovation by either refusing to allow uses

[125] McBride, 2011, "Technologies and Strategies for the Mobile Broadband Capacity Crunch," (May 13, 2011), Traffic growth is just too great. Spectrum capacity will run out (and/or services will suffer), costs of continual expansion of core network and backhaul capacity will undermine operator profitability. Operators are all juggling with the need to divert non-essential traffic off of their networks in order to protect the performance and throughput of these vital assets. Offload is seen as the answer… the immediate future… of identifying and selecting specific types of traffic, content and even devices, creating new paths – outside the operator networks core – for access to and delivery of content. Further down the road, it is all but inevitable that the mobile data network will become a fully distributed environment that behaves like the Internet today, with no central core.

[126] Hovitz, 2007, p. 4, Market forces obviously operate in license-exempt bands even without spectrum pricing – through equipment purchase decisions by countless individuals at the retail level and through manufacturers' product development and marketing decisions at the wholesale level. Regulatory criteria for equipment type acceptance constrain these forces – though not as much as license conditions limit the choices of purchasers, designers and producers of radio equipment for licensed use. In that sense, license-exempt bands are arenas for more creative competition among equipment vendors and service providers than the licensed bands.

[127] Milgrom, et. al. 2011, p 2, [T]he primary benefits of unlicensed spectrum may very well come from innovations that cannot be yet be foreseen. The reason is… that unlicensed spectrum is an enabling resource. It provides a platform for innovation upon which innovators may face lower barriers to bringing new wireless products to market, because they are freed from the need to negotiate with exclusive license holders.

[128] Horvitz, 2007.

that are not in its interest, or appropriating the rents associated with innovation.[129]

- It lowers the hurdle of raising capital, by eliminating the need for a network and focusing on devices.[130]
- It fosters an end-user focus that makes innovation more responsive to consumer demand; indeed, it allows direct end-user innovation.[131]
- It de-concentrates the supply of services compared to the exclusive licensed model, especially for high bandwidth services which tends to result in a very small number of suppliers, particularly in lower density markets.[132]

Unlicensed spectrum lowers transaction costs. If the rules are written leniently, many people will be able to transmit for many purposes. If the rules are written well, interference will be avoided. The FCC's approach to setting aside spectrum for shared use exhibits several characteristics that accomplish the task of managing the common pool resources in a light handed manner. [133]

- The use rules were simple and established an easy set of conditions with which devices had to comply.
- They did not require intensive, continuous monitoring and coordination.
- There were no membership rules. Anyone could enter and use the shared resource.

Beyond these traditional economic factors, the unlicensed model creates a much more diverse sector. Diversity has come to be recognized as a uniquely important characteristic of economies and economic systems because it reinforces desirable economic traits of the system.[134] Diversity creates value, enhances innovativeness and builds resilience, as well as promoting other social values like pluralism. Diversity is created by three systemic characteristics – variety (the number of firms), balance (market shares of firms) and disparity (the differences between the firms). Adding an additional cellular service provider may increase variety and may improve balance if the new provider gains market share, but it does not increase disparity. The diversity that a different ownership model introduces into the communications ecology provides the uniquely significant benefit of introducing a different perspective that is ideal for enhancing diversity.[135]

---

[129] Milgrom, et al., 2011, 13.

[130] Lemstra and Groenwegen, 2011b, p. 373, "Multiple product vendors and, later, service providers have been seen to be willing to invest in the development of products and service to exploit the unlicensed part of the RF spectrum." One could argue that this is the result of the return on investment largely being based on the sale of Wi-Fi equipment, and not on the exploitation of a service requiring complementary and deep investment in the creation of a network infrastructure, as is the case in mobile cellular communications.

[131] Von Hipple, 2005, has emphasized the importance of user innovation. Cooper, 2006, discusses the importance of end-user innovation and local knowledge in collaborative production in digital product spaces, including Wi-Fi and mesh networking.

[132] The intensity of the debate over ownership models is equaled or exceeded by the intensity of the debate over whether the dramatic increase in concentration of the cellular service sector has resulted in the abuse of market power. Cooper, 2011b, shows that economies of scale and scope and industry concentration have both typified the decade of development of wireless broadband, making it difficult, if not impossible, to disentangle the two.

[133] Cooper 2005, applied the framework developed by Ostrom to mesh networks, discussing the eight sets of rules that have been identified. The FCC boiled the management challenge down to primarily one set of rules – position rules that define what users of the resource are allowed to do. Milgrom, et al. (p. 14), describe the FCC approach to shared public use spectrum as a "managed commons. " In fact, it has succeeded because it relies on as little management as possible to get the job done.

[134] Stirling, 2000, Benhamou, et al., 2009.

[135] It is important to note that the benefit of diversity in ownership models in the digital age is not limited to the example of spectrum reserved for or made available to shared use by the public. In fact, we find a similar outcome across a number of areas of the digital economy. Cooper, 2006, analyzes several examples. In software development, proprietary and open source software have both

The past two decades have demonstrated that the effectiveness of ownership models is an empirical matter. Unlicensed spectrum has proven to be at least as effective as, and probably more effective than, exclusive licensing in preventing interference/congestions, incenting investment and stimulating innovation and economic activity. Even the holders of exclusive licenses who use it for cellular communications have recognized the immense value of unlicensed use spectrum and have relied on it to lower their own costs and expand their service offerings. The success of unlicensed use and the strong complementarity between the unlicensed use and exclusive licensed models supports the conclusion that spectrum should be made available for both models. Public policy that fails to allow for both models to expand is likely to reduce the output of the spectrum. Therefore, assuring that adequate spectrum is set aside for unlicensed use should be a goal of public policy.

AUCTIONS ARE AN INEFFECTIVE MEANS FOR MAKING SPECTRUM AVAILABLE FOR UNLICENSED USE

The immediate question confronting policy makers is – are auctions a good mechanism to achieve that goal? The answer is no – "Any such auction would be decisively biased against unlicensed uses, even in cases where the unlicensed uses would be far more valuable than the licensed ones."[136]

Large, Incumbent Cellular Providers Dominate Auctions & the Holding of Spectrum Licenses

Auctions are certain to result in little, if any, spectrum being allocated to the unlicensed use model.[137] Given the history of spectrum auctions in the United States, they will fail to address the problem of the market power of the incumbent cellular providers and fail to reflect the externalities and transaction cost efficiencies of unlicensed use spectrum. Opponents of setting aside spectrum for unlicensed use have put forward a highly implausible model in which groups of companies

---

grown side-by-side. Sometimes they reinforce one another, as in the extensive support provided to open source projects by proprietary software firms. Sometimes they compete, as in the rivalry between Microsoft, Apple and Linux in operating systems or Apple and Android in the mobile operating system product space. In the desktop computing product space, the PC open platform and the Apple closed platform have existed side-by-side for decades. When the smaller, closed platform ultimately supported the larger open platform it gained substantial market share, creating more balance. In the production and distribution of content, peer-to-peer networks exist alongside hub-and-spoke networks and are used to alleviate congestion on or efficiently manage the resource of those networks (Cooper, 2011a). The real world experience during the past quarter century (which is roughly the first quarter century of the digital revolution) strongly supports the conclusion that diversity of business models **and** ownership approaches creates an environment that stimulates economic growth and dynamic innovation. While collaborative production based on non-property exploitation of common pool resources has long coexisted with the private exploitation of resources, the two ownership models tended to occupy very different spaces and the collaborative model has played a much smaller role in industrial society. Digital technology seems to be supporting a broader role for collaborative production. Digital technologies enable the embodiment of knowledge in silicon chips, which facilitates the decentralization of intelligence and promotes distributed innovation. Digital communications dramatically lower the cost of communications, which enhances coordination as a result. The digital revolution has fostered the convergence of areas in which the two models can exist side-by-side and expanded the role of collaborative production.

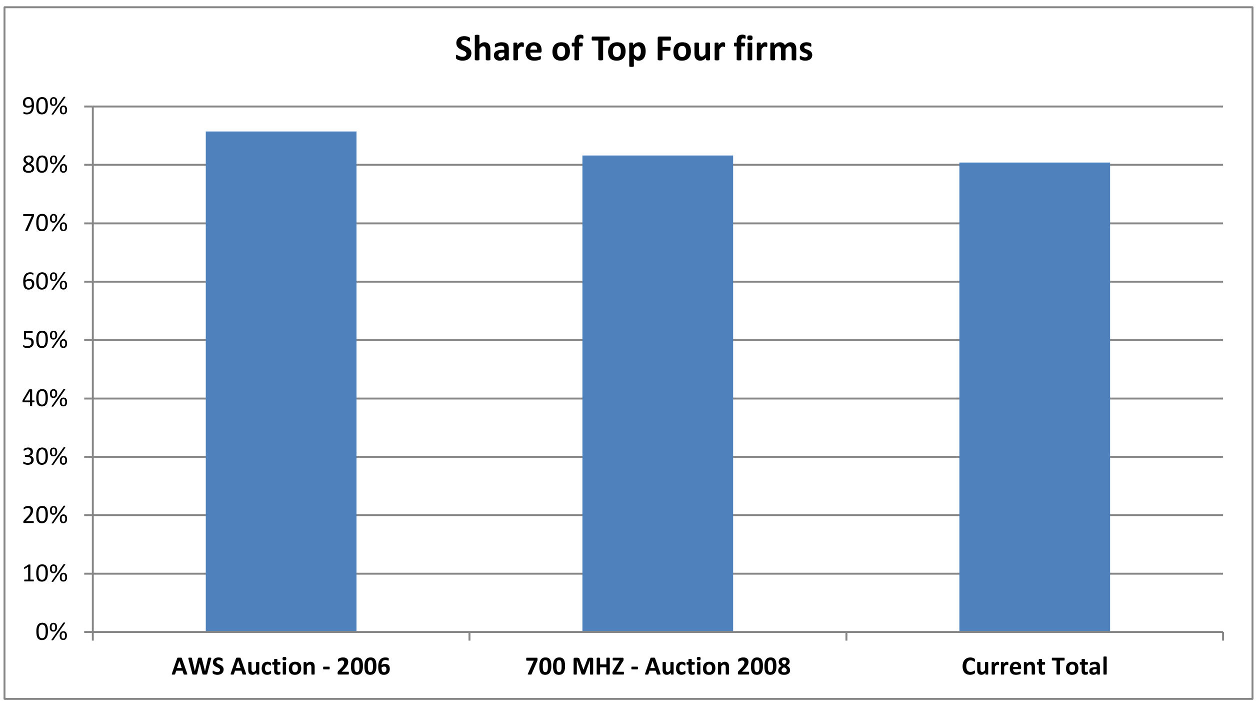
[136] Milgrom, et al., 2011, p. 26.

[137] If public policy is to reflect economic reality, it must reflect the fact that the two models are effective solutions to the coordination problem. Economic analyses or public policies that assume exclusive licenses are superior to shared use spectrum are simply wrong. The suggestion that auctions can be configured to yield the "socially" optimal amount of shared use spectrum has been thoroughly criticized. First Rose argues that the game theoretic outcomes that demonstrate the superiority of auctions are based on biased assumptions about the ability of institutional models to manage interference and congestion. The dice are loaded, so to speak, by the assumption that the exclusive license model is one that is assumed to work best in managing interferences. Rose, 2011, p. 9, "The game, bluntly put, and rigged in such a way as to make unlicensed spectrum simply a spurned modality of licensed spectrum.,,, do these games and etiquettes resemble anything which empirically obtains in the world? The answer has to be no." In fact the past decade has shown that, if there is anything, the shared use model has proven more adept at managing interference and congestion, Rose, 2011, p. 5, "This is particularly pertinent if the advantages of digital technology – which allow the possibility of intelligent devices and modes of user interaction which make spectrum far closer to a non-rivalrous than a rivalrous good – hold….This is particularly tragic because the reasons for which auctions, arguably promote efficiency for licensed spectrum do not apply to unlicensed spectrum. In fact, just the opposite applies. Milgrom et. al., 2011, argue that the distribution of incentives and resources of bidders do not reflect reality. The small number of large cellular license holders has resource and organizational advantages in the auction process that bias the outcome of the auction in their favor at the expense of the large number of much smaller beneficiaries of shared use spectrum. License holders have an incentive to overbid for spectrum to keep it out of the hands of potential competitors. Shared use beneficiaries face obstacles that lead them to underbid, or prevent them from bidding altogether.

interested in exclusive licenses are pitted against groups of companies interested in unlicensed spectrum.[138] Such a contest would be totally one sided, loaded in favor of the group pursuing exclusive licenses.

Looking at auctions in the last decade and subsequent mergers and acquisitions, two-thirds of all spectrum auctions ended up in the hands of the top two companies (see Exhibit VII-1). The top four firms have acquired 80 percent of the spectrum. Post-auction mergers, acquisitions and joint ventures have increased the concentration of control of spectrum. Here it is important to recognize that the marketplace would put virtually all of the auctioned spectrum in the hands of the dominant incumbents through auction, merger and acquisition in less than a decade if regulators do not stop the process. Whether or not the proposed acquisitions are allowed to close by regulatory authorities, they make it clear that the largest incumbent cellular operators thoroughly dominate the exclusive licensed space.

EXHIBIT VII-1:
LICENSED SPECTRUM FOR BROADBAND IS HIGHLY CONCENTRATED AND RECENT AUCTIONS HAVE ALLOWED LARGE FIRMS TO INCREASE THEIR DOMINANCE



Source and Notes:

Top 4 firms are Sprint-Clearwire (Joint Venture), AT&T, Verizon, and T-Mobile. Current shares are from Federal Communications Commission, *Fifteenth Report In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 10-133, June 27, 2011. Auction shares are from FCC Auction Database, year shown is the completion date. Total spectrum available for broadband is from Coleman Bazelon, Charles L. Jackson, and Giulia McHenry, "An Engineering and Economic Analysis of the Prospects of Reallocating Radio Spectrum from the Broadcast Band through the Use of Voluntary Incentive Auctions," *Telecommunications Policy Research Conference,* September 19, 2011, Table 4 based on Potential Supply.

---

[138] Bykowsky, Olson, and Sharky, 2008,

Incumbent cellular service providers are likely to be the big winners in auctions for spectrum for several reasons.[139] Incumbents

- have deep pockets,
- already possess communications infrastructure,
- concentrate demand and decision making,
- are primarily telecommunications companies, and
- have a strong incentive to bid to foreclose competition.[140]

Indeed, in the context of auctions of spectrum in a communications sector that has become highly concentrated, the cellular service providers have an incentive to keep competition out. By denying spectrum to potential or actual competitors, they increase their own ability to extract the rents that flow from their market power.

> Unfortunately, an auction that awards the spectrum to the bidders with the highest values may not assure efficiency because of the bidders' private values for the spectrum may differ from social values as a result of market structure issues. For example, an incumbent will include in its private value not only its use-value of the spectrum but also the value of keeping spectrum from a competitor. Effective policy must recognize competition issues in the downstream market for wireless services.[141]
>
> Moreover, the incumbent can potentially limit entry, and hence competition, by purchasing additional spectrum that would otherwise go to the incumbent… part of the willingness to pay in the auction for the incumbent comes from the value of deterring entry, which is bad for overall efficiency for the standard market power reasons and may be bad for the dynamic evolution of the service if the threat of competition is necessary to speed up build out and development of new technologies.[142]

The push by incumbent cellular network operators to prevent the FCC from imposing any conditions on the auction of spectrum, coming after the failure of past auctions to stimulate competition and amid vigorous efforts by the incumbent wireless carriers to obtain more spectrum through mergers and acquisitions shines a bright light on the effort of the incumbents to deny additional high quality spectrum for the unlicensed model. The unlicensed space has long been the most competitive area of the wireless market and, as we have seen in the discussion of future development, it may be the last hope for meaningful competition in the broadband space.

> The reason we prefer allocating the spectrum as dedicated unlicensed is this provides a well understood model for ensuring open and non-discriminatory access to the resource – not just for incumbents but potential future entrants. Preserving the option for future entry helps ensure that the bottleneck resource (spectrum) is not cartelized so as to limit competition (and thereby, also hampering prospects for innovation).[143]

---

[139] Cramton, et al., 2011 p.1. Most spectrum auctions, however, are held in a… complex environment. In particular, a common asymmetry in the auction is the distinction between an incumbent and an entrant. The incumbent has existing customers, network infrastructure, and spectrum; the entrant does not.

[140] Milgrom, et al., 2011, p. 13, identify a foreclosure premium that incumbent license holders may pay – bidding prices up to keep potential competitors from entering the market – [A]uction theory tells us that the type of mechanism used to allocate spectrum, if they work well, will tend to maximize industry profits, and one expects industry profits to be higher with more concentration.

[141] Cramton, et al., p.1.

[142]

[143] Chapin and Lehr, 2010 p. 27.

Exclusive License Winners will Not Provide Spectrum for Unlicensed Use

Cellular providers will certainly not take care of unlicensed use spectrum. In the context of an auction to allocate exclusive licenses, it is highly unlikely that if the winners are in the cellular communications business they will act in a manner that reflects the value of the two models. It is highly unlikely that licensees will allow access to the exclusive licensed spectrum that they have obtained in an auction in a manner that is as unfettered as under the unlicensed use model. The behavior of the incumbent occupants of spectrum strongly suggests that license holders do not share easily or well. Having bid for spectrum, winners are not likely to then set aside the spectrum for unlicensed use.[144] They will have a strong economic incentive to exclude "free riders" and charge for use of "their" spectrum. Access will be "authorized" and costly. They are certain to encumber access to the spectrum, charging for its use, resisting applications that might compete with their core businesses, seeking rents from new applications that do not compete, etc. Thus, they will create the problems that setting aside spectrum for unlicensed use is intended to solve. They will become gatekeepers, recreating and exploiting the spectrum barrier to entry the unlicensed access removed.

The Beneficiaries of Unlicensed Use are Unlikely to Win Adequate Spectrum at Auction

Pitted against this small group of large, specialized communications companies is an ill-defined and diverse set of companies and end users that may use unlicensed spectrum for a small part of their overall economic activities.

> An advantage of open access, service neutral, unlicensed bands is that there seem to be innumerable applications which were not predictably lucrative enough to justify the cost of securing a license, but which proved valuable in the aggregate once they existed… So it is highly desirable to have space in the radio frequency spectrum for mass market experiments. Many see an analogy with the Internet: the ability to release new content and applications to a potentially global audience at relatively low cost and without difficult authorization procedures seems to stimulate creativity and new business activity like nothing else.[145]

Those who benefit from unlicensed use spectrum are unlikely to be able to win at auction for several reasons.[146]

- Diffuse and unforeseeable future benefits mean that potential users will undervalue unlicensed public use spectrum.

---

[144] Lamberth, 2011, "Even though the FCC has already approved unlicensed use of TV white spaces, several members of the U.S. congress proposed auctioning access to TV white spaces during the summer's debt ceiling debates. While the legislators are hoping for a financial windfall to help close the U.S. budget gap, industry insiders wonder why anyone would pay for non-exclusive access to intermittently-available spectrum.

[145] Horvitz, 2007, 4.

[146] Milgrom, et al., 2011, p. xx, "What makes such ideas untenable is that too many of the beneficiaries – future innovators and consumer in the case of unlicensed spectrum – are difficult or impossible to identify at the time of the auction… ignorance about who the future individual users will be or what their value will be cannot justify overlooking those users and values, as would surely happen with such an auction (2)… "While allowing market forces to determine the allocations between licensed and unlicensed might superficially appear to be an attractive option, it is not a practical alternative. Auction markets work best when one can identify the relevant bidders in advance, bring them to auction, inform them what is for sale, and motivate them to bid…. [T]here is a diverse and emerging group of devices that use and benefit from unlicensed spectrum… Even the group of existing beneficiaries is too large and diverse to be identified, informed and motivated to bid, particularly when individual beneficiaries cannot expect their bids to have any effect on the outcome. And without knowing how many other users there might be or how much interference might arise, they would be unable to make realistic estimates of value…. Moreover, the importance of innovation to capture the full benefits of unlicensed spectrum would make it even more implausible that beneficiaries of unlicensed spectrum could be assembled. For potential innovators who may use unlicensed spectrum, the main problems are that they are numerous, their identities are unknown; their participation is costly, making it hard to bring them to auction; and the very nature of innovation makes their information about future benefits unreliable."

- The public is not likely to be eligible to bid and the transaction costs of enabling public bidding would be staggering.
- Each individual, non-telecommunications company that might bid, will be self-interestedly short sighted, unable to see the potential future value.
- Because of the decentralized nature, it is highly unlikely that the army of potential users can band together to claim the spectrum at auction, or that the auctioneer can aggregate their bids to set aside spectrum.
- The hospitals, libraries and universities that have been blanketed with Wi-Fi and other unlicensed spectrum applications are very unlikely bidders, as are the infinite array of enterprises that will benefit from RFID applications.[147]

It is interesting to compare the companies who have been offered up as potential future bidders for unlicensed use spectrum to the telecommunications giants who have and are likely to bid for exclusive licenses.[148]

- Many of the companies in the unlicensed use category did not exist when the unlicensed use spectrum model was first implemented in 1985 (Google, Skype, Frontline, Yahoo, Ask.com Cisco, Juniper Networks Panera Bread).
- Many did not exist when the spectrum auctions began. It is exactly these unforeseeable beneficiaries whose interests are not taken into account an auction.
- The only company that was primarily a telecommunications company has gone out of business (Frontline).
- Others have bleak futures (Yahoo).
- Those that have been around for a long time (e.g. Marriot, Starbucks) are in a completely different line of business.

On the other hand, the telecommunications giants who are identified as likely bidders (AT&T, Verizon and T-Mobile)

- have been around from the beginning,
- have dominated the auctions in the wireless data era, and
- are, on average, ten times the size of the members of the group of presumed bidders for unlicensed use spectrum.

If the asymmetry between incumbents and new entrants who are in the communications business is a problem, as noted above, that problem is greatly magnified when firms that are not in the communications business at all are required to put a value on communications service.

In short, economic analysis that purports to show that spectrum auctions could be designed to meet the needs of the unlicensed use model are based on two sets of assumptions that are contradicted by reality. They incorrectly assume that exclusive licensed spectrum is better equipped to manage interference and to maximize economic value. They also incorrectly assume

---

[147] Lamberth, 2011, "Worse, the proposal would allow a single bidder to swoop in and outbid the total of all other bidders for white space access. In that case, the single bidder would gain an exclusive license to use white spaces, effectively killing public and community access to white spaces."

[148] Bykowsky, Olson, and Sharky, 2008,

that the auction represents a level playing field between the beneficiaries of exclusive licensed use and unlicensed use spectrum.

Making Spectrum Available for Unlicensed Use Will Reduce the Deficit

Given the success of the unlicensed use model and the potential benefits it could provide in the future, the best argument for making spectrum available for unlicensed use in the context of the budget deficit debate is that it is likely to decrease the deficit in the long term for the following reasons.

- First, if the supply of spectrum for exclusive licenses at auction is reduced, the cellular providers will bid up the price of the spectrum that is auctioned. Given the fact that the cellular service providers have declared a "spectrum crisis," it would be reasonable to assume that they will bid up the price substantially.[149]
- Second, the expansion of economic activity associated with the spectrum set aside for unlicensed use generates tax revenues[150] at a higher tax rate than exclusive licenses because the purchase price of the spectrum is not claimed as a business expense.[151]

Providing precise quantitative estimates of the impact of auctioning spectrum is difficult. The Congressional Budget Office "scores" it in the range of a few billion dollars at most, after the costs of clearing the spectrum are taken into account. If the failure to make high-quality spectrum available for unlicensed use reduces the output of the sector by ten percent, (a low estimate given the extremely important role that it has played to date) the loss would be $100 billion or more over the next decade and federal revenues would be reduced by tens of billions of dollars.[152]

As the debate over spectrum auctions has unfolded, the facade of concern about revenues has been pierced by several issues that raise alternative explanations. For example, the steadfast opposition of the dominant incumbents to allowing the FCC to design auctions to ensure they have a procompetitive impact highlights the market structural aspects of the debate.

---

[149] Milgrom, et al, 2011, p. 23, "First, the reduction in the supply of spectrum is likely to increase the per unit price. If the aggregate demand for licenses is relatively inelastic… would by itself, actually increase the revenue that can be expected from a given auction. We are not aware of convincing estimates of the aggregate demand for licensed spectrum. Bulow, Levin and Milgrom (2009), however, have pointed out that in large spectrum auctions; the overall revenue tends to reflect the aggregate budgets of the participants. To the extent that telecommunications firms allocate budgets for spectrum purchases that are relatively insensitive to changes in available spectrum, and tend to spend their budgets at auction, changes in the available spectrum will have only modest effect, if any, on government revenue.

[150] Milgrom, et. al., 2011, p. 23' "A second point is that complementarity between licensed and unlicensed spectrum can lead to a situation where unlicensed spectrum applications increase the demand for licensed spectrum applications and lead to higher license prices."

[151] Milgrom, et al., 2011, p. 2, Another goal in many auction setting is raising revenue. A pro-efficiency argument for maximizing revenues is that substituting auction revenues for revenues raised through distortionary taxes saves dead-weight loss of those taxes. Yet, maximizing revenues often conflicts with the goal of creating a competitive market for wireless services. First, reducing the amount of available spectrum would typically increase auction revenue, but restrict the development of wireless services. Second, selling the rights to be a monopolist can raise much more revenue than selling license to many competing providers, to the detriment of post auction competition and efficiency.

[152] These observations are supported by an analysis of social surplus under the conditions in the wireless market as described throughout this paper. In the absence of the complementarities available with unlicensed spectrum, demand is lower and becomes more elastic because of more churn. In the absence of efficiencies associated with unlicensed spectrum, costs rise more rapidly at the margin since the costs of reducing congestion increase). Total output declines. However, auction revenues are essentially unaffected in the short-term by making spectrum available for unlicensed use since the reduction in supply increases bid price, offsetting the reduction in quantity. The producer surplus remains about the same but the consumer surplus is reduced. Long-term general economic activity is reduced significantly because of the large decline in consumer surplus. Total social surplus declines by about as a result of the reduction in available unlicensed use (consistent with current offloading). The vast majority of the reduction in total social surplus comes in the form of a reduction of consumer surplus.

> Wireless Competition Bureau Chief… said the agency's two major "sticking points" with the GOP billare restriction on the FCC's ability to "foster competition in the market" and to decide how much spectrum should be dedicated for "unlicensed" use.[153]

The fact that the transaction costs of scrapping the old system (bribing the broadcasters to move) are fifteen times the transformation costs of moving to a new system (implementing technologies to repack the spectrum). The amount of money that will be paid to the broadcasters is larger than the impact the disputed conditions would have on the auction revenues, yet, there is no legal reason the ransom should be paid. It is not unnecessary to pay the ransom.[154]

CONCLUSION

Avoiding Another 100-Year Mistake

A plausible case can be made that the spectrum should be split equally between the exclusive license and the unlicensed public use models. However, because the unlicensed use model exploits spectrum so much more efficiently, it can thrive on less than half. Today, exclusive licensing occupies five times the spectrum in the 500 MHz to 1GHz frequencies as unlicensed use. If none of the next 120 MHz to be auctioned is made available for unlicensed use – exclusive licenses will have the use of ten times as much high-quality spectrum. This imbalance will distort the development of the sector and will fly in the face of the demonstrated ability of an open access model to avoid interference and therefore promote communications in a much more consumer-friendly manner.

Next year marks the 100 year anniversary of the initial decision to give exclusive licenses to individuals to use the spectrum. The problem with such an approach is that, over time, as technology changes, the ability to use the spectrum changes and improves. What were the most valuable uses at one moment, or even the only technologically feasible uses, may no longer be the best use of spectrum. The holders of licenses hesitate to give them up, even if they were never intended to be permanent exclusive licenses. Thus, choosing regimes to allocate spectrum to users and uses tends to be very "sticky;" once they are made they are difficult to change. For at least fifty years, it has been recognized that the original scheme for licensing spectrum in the United States is no longer efficient.

Ironically, Congress is threatening to make another 100 year mistake by favoring one ownership model to the exclusion of another. Exercising it independent expert judgment, the FCC set aside several small slivers of spectrum that became the basis for the remarkable success of the unlicensed model. The key to the success was removing the spectrum barrier to entry and combining free market principles with shared access to a bottleneck essential facility. Some members of Congress want to prevent the FCC from exercising that judgment in the future. They propose to recreate the barrier to entry by requiring that all spectrum be auctioned, which guarantees that none will be made available for the continuing expansion of the unlicensed model.

---

[153] Dailywireless.org, 2011.

[154] None of the TV broadcast licenses are permanent. All of them will expire in the next decade. None of the TV licenses were acquired at auction. They were all granted to the broadcasters, at no cost, before auctions were adopted as the approach to allocating spectrum. Instead of paying broadcasters to return licenses they were given for free; policy makers could require them to bid for those licenses when they are up for renewal. If they reject the offer of a no-cost relocation, they should be required to participate in the auction. The broadcasters are not likely to win the auctions because their core competence lies in an inferior use of the spectrum.

The second 100-year mistake will be an even bigger tragedy because Congress should know better. Back in 1912, the radio industry was new, the technology was primitive and there was little basis on which to consider alternative approaches. Today, the demonstrated success of the unlicensed use model provides a very strong basis to conclude that given access to spectrum with more attractive propagation characteristics, the unlicensed use model will perform at least as well as the exclusive licensed model, and the overall sector will perform much better. If legislation fails to make more spectrum available for unlicensed use, it will truly be a tragedy of the Congress.

- Policy makers should ensure that unlicensed model has access to a share of the high-quality spectrum that is not smaller than it has today – one-sixth.
- The FCC should be empowered to allocate up to one quarter of future spectrum that comes available for unlicensed use, if unlicensed use continues to prove to be effective at utilizing the spectrum without interference and at stimulating innovation.

BIBLIOGRAPHY

Anker and Lemstra, 2011, Peter Anker and Wolter Lemstra, "The Governance of Radio Spectrum: License – Exempt Devices, "Lemstra, Hays and Groenewgen (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press

ATT, 2011, Media Kit: ATT Wi-Fi, http://www.att.com/gen/press-room?pid=17541

ATT, 2011,b, (http://customer.comcast.com/Pages/FAQViewer.aspx?Guid=8112d506-993e-4b79-a46c-746cef568621)

Bazelon and Jackson, 2011, Coleman Bazelon, Charles L. Jackson and Giulia McHenry, "An Engineering and Economic Analysis of the Prospects of Reallocating Radio Spectrum from the Broadcast Bands through the Use of Voluntary Incentive Auctions, *TPRC*

Benhamou, et al., 2009, Francoise Benhamou, Reanto G. Flores, Jr. and Stephanie Peltier, *Diversity in Cultural Economics: Theoretical and Empirical Considerations,* Granem, Universite Angers, September

Benkler, 2011, Yochai Benkler, *Unlicensed Wireless vs. Licensed Spectrum: Evidence from Market Adoption*

Benkler, 2002, Yochai Benkler, "Some Economics of Wireless communications," *Harvard Journal of Law and Technology, 16:1*

Benkler, 1998, Yochai Benkler, "Overcoming Agorphobia: Building the Commons of the Digitally Networked Environment, *Harvard Journal of Law and Technology, 11:2*

Bykowki, et al., 2008a, Mark M. Bykowsky, Kenneth Carter, Mark A. Olson and William w. Sharkey, *Enhancing Spectrum's Value Through Market-Informed Congestion Etiquettes,* February

Bykowsky, Olson, and Sharky, 2008b, Mark N. Bykowsky, Mark A. Olson, William W. Sharky, *A Market Based Approach to Establishing Licensing Rules: Licensed Versus Unlicensed Use of Spectrum*, OSP Working Paper Series No. 43

Carter, 2006, Kenneth R. Carter, "Policy Lessons from Personal Communications Services: Licensed vs. Unlicensed Spectrum Access," *Commlaw conspectus,* 15

Chapin and Lehr, 2010, John M. Chapin and William H. Lehr, "SCADA for the Rest of Us: Unlicensed Bands Supporting Long-Range Communications," *38th Research Conference on Communications, Information and Internet Policy*

Chapin and Lehr, 2011, John M. Chapin and William H. Lehr, "Mobile Broadband Growth, Spectrum Scarcity, and Sustainable Competition," *39th Research Conference on Communications, Information and Internet Policy*

Chiu, 2010, Michael Chiu, Markus Loffler and Roger Robrts, "The Internet of Things," *McKinsey Quarterly,* March

Charma, 2011, *Us Wireless Market – Q4 2010 & 2010 Update,* February

Cisco, 2011a, *The Future of Hotspots: Making Wi-Fi as Secure and Easy to Use as Cellular,* Cisco White Paper, June

Cisco, 2011b, *Entering the Zetabyte Era,* Cisco White Paper, June

Coase, 1959, Ronald Coase, "The Federal Communications Commission, *Journal of Law and Economics,* 2:1

Comcast, 2011, http://www.att.com/u-verse/explore/internet-landing.jsp?fbid=aVuctrtx7yL

ComScore, 2011, ComScore, *Digital Omnivores: How Tablets, Smartphones and Connected Devices Are Changing U.S. Digital Media Consumption Habits*, October

Cooper, 1990, *Expanding the Information Age for the 1990s: A Pragmatic Consumer Analysis*, January 11

Cooper, 2003, Mark Cooper," *Making the Network Connection,* in Maark Cooper (Ed.), *Open Architecture as Communications Policy,* Center for Internet and Society, Stanford

Cooper, 2005, "The Economics of Collaborative Production in the Spectrum Commons," *IEEE Symposium on New Frontiers in Dynamic Spectrum Access Networks*, November

Cooper, 2006a, Mark Cooper, "From Wifi to Wikis and Open source," *Journal on Telecommunications & High Technology Law*, 5:1

Cooper, 2006b, Mark Cooper, "Governing the Spectrum Commons," September 2006. *Telecommunications Policy Research Conference,* October 2006

Cooper, 2011a, Mark Cooper, "Structured Viral Communications: The Political Economy and social Organization of Digital Disintermediation, *Journal on Telecommunications and High Technology Law, 9:1*

Cooper, 2011b, Mark Cooper, ""The Central Role of Wireless in the 21st Century Communications Ecology: Adapting Spectrum and Universal Service Policy to the New Reality," *Telecommunications Policy Research Conference*, September
CPS, 2011, Current Population Survey, reported in *Exploring the Digital Nation: Computer and Internet Use At Home, NTIA,* November
Cramton, et al., 2011, Evan Kwerel, Gregory Rosston and Andrzej Skrrzypacz, *Using Spectrum Auctions to Enhance Competition in Wireless Services,*
Cristi, 2010, Cristi, "AT&T Reports Significant Wi-Fi Growth," *Padgadget.com,* October 22
Cromar, 2010, *Smartphones in the U.S. Market Analysis,* November 29
CTIA, *Cellular Telecommunications Industry Association, Semi- Annual Wireless Survey*, various issues
de Vries, 2008, Peter de Vries, *De-Situating Spectrum: Rethinking Radio Policy Using Non-Spatial Metaphors,* SSRN Papers id=1241342
Dediu, 2011, "The US Smartphone Landscape," *Asymco,* November 6
Dineen, 2009, Richard Dineen, *The Capacity Crunch: What Can Mobile Telecoms Operators do as "Moore's Law Mobile" Breaks Down?* HSBC, December 8
Economist, 2004, The Economist, *A Brief History of Wi-Fi,* June 10
Faulhaber and Farber, 2009, Gerald R. Faulhaber and David J. Farber, *Innovation in the Wireless Ecosystem: A Customer-Centric Framework*
FCC, Federal Communications Commission, *Trends in Telephone Service*, various issues
FCC, Federal Communications Commission, *Internet Access Services,* various issues
FCC, Federal Communications Commission, *Cable Competition Report,* various issues,
FCC Federal Communications Commission, *Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, various issues,
FCC, 2010, Federal Communications Commission, *Mobile Broadband: The Benefits of Additional Spectrum,* OBI Technical Paper No. 6.
Fatemieh, Chandra and Gunter, N.D.,Omid Fatemieh, Ranveer Chandra, and Carl A. Gunter, *Low Cost and Secure Smart Meter Communications Using the TV White Space.*
Flaherty, 2011b, Nick Flaherty, "Consumer Wi-Fi Drives Global Growth," *The Embedded Blog,* May 28, 2010;
Flaherty, 2011a, Nick Flaherty, "Consumer Wi-Fi Drives Global Growth: Wi-Fi chip shipment to surpass 770 million in 2010, up 33%," *The Embedded Blog,* May 26, 2010;
Forge, Horvitz and Blackmun, 2011,
Goldstein, 2011, P. Goldstein, "Verzon to Offload EV-DO, LTE Traffic on Wi-Fi, *FierceWireless,* May so
Gunwald, 2011, Dirk Grunwald, *How New Technologies Can Turn a Spectrum Crisis Into a Spectrum Opportunity,* February 2011.
Hallahan and Peha, 2011, Ryan Hallahan and Jon M. Peha, *Quantifying the Cost of a Nationwide Broadband Public Safety Network,* Carnegie Mellon University, Research Showcase, September 1, 2008.
Hazaray, 2011, Rajiv Hazaray, *The Economic Value of Broadcast Innovation U.S. Treasury Impact*, Business Analytics
Hazlett, 1990, Thomas Hazlett, "The Rationality of US Regulation of the Broadcast Spectrum, *Journal of Law and Economics,* 33
Hazlett, 2001, Thomas W. Hazlett, "The Wireless Craze, the Unlicensed Bandwidth Myth, the Spectrum Auction Fauzx Pas, and the Punchline to Ronald Coase's Big Joke: An Essay on Airwave Allocation Policy," *Harvard Journal of Law and Technology, 14:2*
Hazlett, 2008, Thomas W. Hazlett, "Optimal Abolition of FCC Spectrum Allocation, *Journal of Economic Perspectives, 22:1*
Higginbotham, 2011, Stacy Higginbothan, "Wi-Fi: It's the Other Cell Network," *Giga.com*, July 1
Higginbotham, 2011, Stacy Higginbotham, "After iPhone, Connected Devices Emerge as AT&T's Savior," *Tech New and Analysis,*February 28
Horvitz, 2007, Robert Horvitz, *Beyond Licensed v. Unlicensed: Spectrum Access Rights Continua,* ITU, January
Iluna, 2011, Iluna, "Wi-Fi offload for mobile networks: 20% of traffic and counting," *Fierce Broadband Wireless,"* February 25
Informa Telecoms and Media, 2011, Informa Telecoms and Media, *Global Deployments in Public Wi-Fi,* Wireless Broadband Alliance
ITU, 2011, ITU, ICT Data and Statistics, database

Jakobs, Lemstra and Hayes, 2011, Kai Jakobs, Wolter Lemstra and Vic Hayes, "Creating a Wireless LAN Standard: IEEE 802.11," Lemstra, Hays and Groenewgen (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press

Jessell, 2011, "A Win-Win alternative to Spectrum Auctions," TVNewCheck, November 21.

Jones and Lui, 2007, Kipp Jones and Ling Lui, "What Where Wi: An Analysis of Millions of Wi-Fi Access Point"

Juniper Research, 2011, Juniper Research, "*Relief Ahead for Mobile Data as 63% of Traffic to Move Onto Fixed Networks via Wi-Fi and Femtocells by 2015, Finds Juniper Research.* "

King, 2007, Peter King, "*Digital Home Wi-Fi Enabled Devices: Global Market Forecast and Outlook,"* July 2007

Lamberth, 2011, Lauri Lamberth, 2011, "White Space and the Internet of Things," *MSolve Partners Newsletter,* September

Leigh, 2011, Phil Leigh, "The Wireless ISP Industry & Cellular Wi-Fi Offloading," *Inside Digital Media.com,* Lemstra, 2011b, Wolter Lemstra, "Crossing the Chasm: The Apple AirPort," Lemstra, Hays and Groenewgen (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press

Lemstra, 2011b, Wolter Lemstra, "Hotspots: the Starbucks Initiative," Lemstra, Hays and Groenewgen (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press

Lemstra, and Groenewegen, 2011a, Wolter Lemstra, and John Groenewegen, "The Case and Theoretical Framework," Lemstra, Hays and Groenewgen (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press

Lemstra, 2011b, Wolter Lemstra, "NCR: Taking the Cue Provided by the FCC," Lemstra, Hays and Groenewgen (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press

Lemstra and Groenewegen, 2011c, Wolter Lemstra and John Groenewegen, "Reflections and Implications for Policy and Strategy Formation," Lemstra, Hays and Groenewgen (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press

Lemstra, Hays and Groenewgen, 2011, Wolter Lemstra, Vic Hays and John Groenewgen, (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press Lynn, 2011, Samara Lynn, "Wi-Fi is Leading-Edge Technology in 2011," *PCMag.com,* January 6

Lohr, 2011, Steve Lohr, "The Internet Gets Physical," *New York Time, December 17, 2011*

Marshall, 2011, Phil Marshall, "Mobile Broadband Network Design Key to Profit?" *Enriching Communications,* April 11

McBride, 2011, Dan McBride, "Technologies and Strategies for the Mobile Broadband Capacity Crunch," May 13

Malik, 2009, Om Malik, "How Smartphones are Making Wi-Fi Hot Again," *Tech New and Analysis,* August 18

Malik, 2011, "Smartphones, IPads & the State of the Mobile Internet," *Gigacom.com,* July 25

Meraki, 2011, *Meraki Reveal iPad Use 400% More Wi-Fi Data than the Average Mobile Device,* June, 22

Miaro, 2011, Michelle Maisto, "Verizon $G LTE Grwoth Leading to Data Pooling, WiFi Where Necessary, *eWeek,* May 23

Milgorm, Levin and Eilat, 2011, Paul Milgrom, Jonathan Levin and Assaf Eilat, *The Case for Unlicensed Spectrum,* October 12

Miller, 2011, Mark K. Miller, "Broadcasters to Unveil Broadband Plan," *TV NewCheck,* October 17.

Mofett, 2011, *Weekend Media Blast: Wither Wireless,* Bernstein Research, November 18

Nadel, 2011, Brian Nadel, "Mobile Hotspots: AT&T, Sprint and Verizon Compete on Price, Features, speed: Which Carriers Mobile Hotspot Packs the Most Punch?" *Computerworld,* June 17

Nekovee, 2010, " A Review of Cognitive Radio Access to TV White Spaces," *International Journal of Digital Multimedia Broadcasting*

Nielse, 2011, *The Mobile Media Report*

Nokai and Qualcom, 2011, Nokia and Qualcom, *Authorised Unlicensed Access,* Presentation at the WG FM, May 17

North, 1990, Douglas North, *Institutions, Institutional Change and Economic Performance,* Cambridge University Press

North, 1993, Douglas North, "Economic Performance Through Time," *Prize Lecture,* December 9

Ostrom, 2009, Elinor Ostrom, *Beyond Markets and States: Polycentric Governance of Complex Economic Systems, Prize Lecture,* December 8

Perlman, N.D., *Distributed-Input-Distributed-Output (DIDO) Wireless Technology*
Pew, 2010, Pew Internet and American Life Data, *Spring Change Assessment Survey Data*
Pew, 2011b, Pew Internet and American Life Data, *Americans and Their Cell Phones*, August 15
Pew, 2011a, Pew Internet and American Life Data, *35% of American Adults Own a Smartphone*, July 11
Pew, 2011c, Pew Internet and American Life Data, *Half of Adult Cell Phone Owners have Apps on Their Phones,* November 2
Portio Research, 2011, Portio Research Mobile Factbook
PRNewswire, 2011, "Comcast, Time Warner Cable, and Bright House Networks Sell Advanced Wireless Spectrum to Verizon Wireless for $3.6 Billion," PRNewswire, December 2
Research and Markets, 2011, Research and Markets, Wi-Fi Mobile Handsets in the US, 2010-2015
Research and Markets, 2008, *Global Home Networking and Broadband CPE Outlooks Through 2012*
Roetgers, 2011, Jnako Roetgers, "Wi-Fi. To Overtake Wired Network Traffic by 2015," *Ggacom.com,* June 1
Rose, 2011, Gregory Rose, *A Tale of Two Papers; How Exclusive Auction-Based Approaches Mean the Demise of Unlicensed Spectrum,* Econometric Research and Analysis, June 19
Rossel and Finger, 2011, Pierre Rossel and Matthias Finger, "Exploring the Future of Wi-Fi," Lemstra, Hays and Groenewgen (Eds.), *The Innovation Journey of Wi-Fi: The Road to Global Success,* Cambridge: Cambridge University Press
Ryan, 2005,
Rysav, 2010a, Rysavy Research, *Spectrum Shortfall Consequences,* April 21
Rysav, 2010b, Rysavy Research, *Strategic Use of Wi-Fi in Mobile Broadband Networks,* October 14
Snider, 2006, J. H. Snider, *The Economic Case for Re-Allocating the Unused Spectrum (White Spaces) between Channels 2 and 51 to Unlicensed Service,* New America Foundation, February
Snider, 2011, J/H. Snider, *The Broadcast Industry's Free TV Scam Redux*, November 21
Solsman, 2011,
Stirling, 2000, Andrew Stirling, Andrew, *On the Economics and Analysis of Diversity* (Science Policy Research Unit, University of Sussex
Thanki, 2009, Richard Thanki, *The Economic Value Generated by Current And Future Allocations of Unlicensed Spectrum,* Perspective,
T-Mobile, 2011, T-Mobile Hotspot Locations, https://selfcare.hotspot.t-mobile.com/locations/viewLocationMap.do
Tofel, 2010, Kevin C. Tofel, "Free Wi-Fi Hotspots Outnumber Paid Wi-Fi in the U.S. Says JiWire, *giga.com,* August 18
Von Hipple, 2005, Eric Von Hipple, *Democratizing Innovation,* Cambridge, MIT Press
Vonnagy, 2010a, Andrew Vonnagy, "Customerication of Enterprise Wi-Fi," *Revolution Wi-Fi,* August 28
Vonnagy, 2010b, Andrew Vonnagy, "A Look Ahead to Possible Wi-Fi Industry Trends in 2011," *Revolution Wi-Fi,* December 21
Vos, 2011, Esme Vos, "Increased smartphones and tablet use drives strong Q1 sales of Wi-Fi equipment," *MuniWireless,* May 31
Werbach, N.D., Kevin Werbach, *Radio Revolution: The Coming Age of Unlicensed Wireless,* New America Foundation, Public Knowledge
Wi-Fi Alliance, 2011, Wi-Fi Alliance, Wi-Fi Certified Products,
Wikipedia, Wikipedia, 802.11 standards,
Wireless Broadband Alliance, 2011, Wireless Broadband Alliance, *Global Developments in Public WiFi,*
Wirelesse2e, 2011, "Cost of Adding Network Capacity: More Spectrum or New Sites? Could there be Other Alternatives, "May 17
WNN, 2010, WNN Wi-Fi Net News, "AT&T Wi-Fi Connections Keep Higher Growth with Free Service," October 22
Woyke, 2011, Elizabeth Woyke, "Automatic Wi-Fi Offloading Coming to U.S. Carriers," *Forbes,* April 22

ATTACHMENT D:
DIFFUSION OF INNOVATION

A. RECOGNIZING THE ROLE OF SUPPLY AND DEMAND

The innovation diffusion process has typically been represented as a logistic (S) curve that represents the overall flow of product development and adoption actions (see Figure V-1). Figure V-1 shows the supply-side process preceding and overlapping with the demand-side process. It depicts the supply-side of the innovation process as moving through three phases, while the demand side of the process moves through five phases. The phases are created by processes that take place within organizations and markets.

On the supply side, in the first phase, technology incubates and emerges from research and development to be launched. The early supply-side period is very challenging and has been called the "valley of death" that must be traversed if the product is to advance.[1] The product undergoes continuous development as it is commercialized and is successful, a process that has been called the slope of enlightenment.[2] The product stabilizes as it matures and then saturates the market. Saturation may not be at 100 percent, since some parts of the market may never adopt a product for a variety of reasons.

SUPPLY: Incubation > R&D > Launch > Commercialization > Business Success
Research > Concept > Tech. > Prod. > Prod.
Invent Dev. Dev. Mktg.

DEMAND: Takeoff > Growth > Slowdown > Early Maturity
(acceleration) (inflection) (Deceleration)

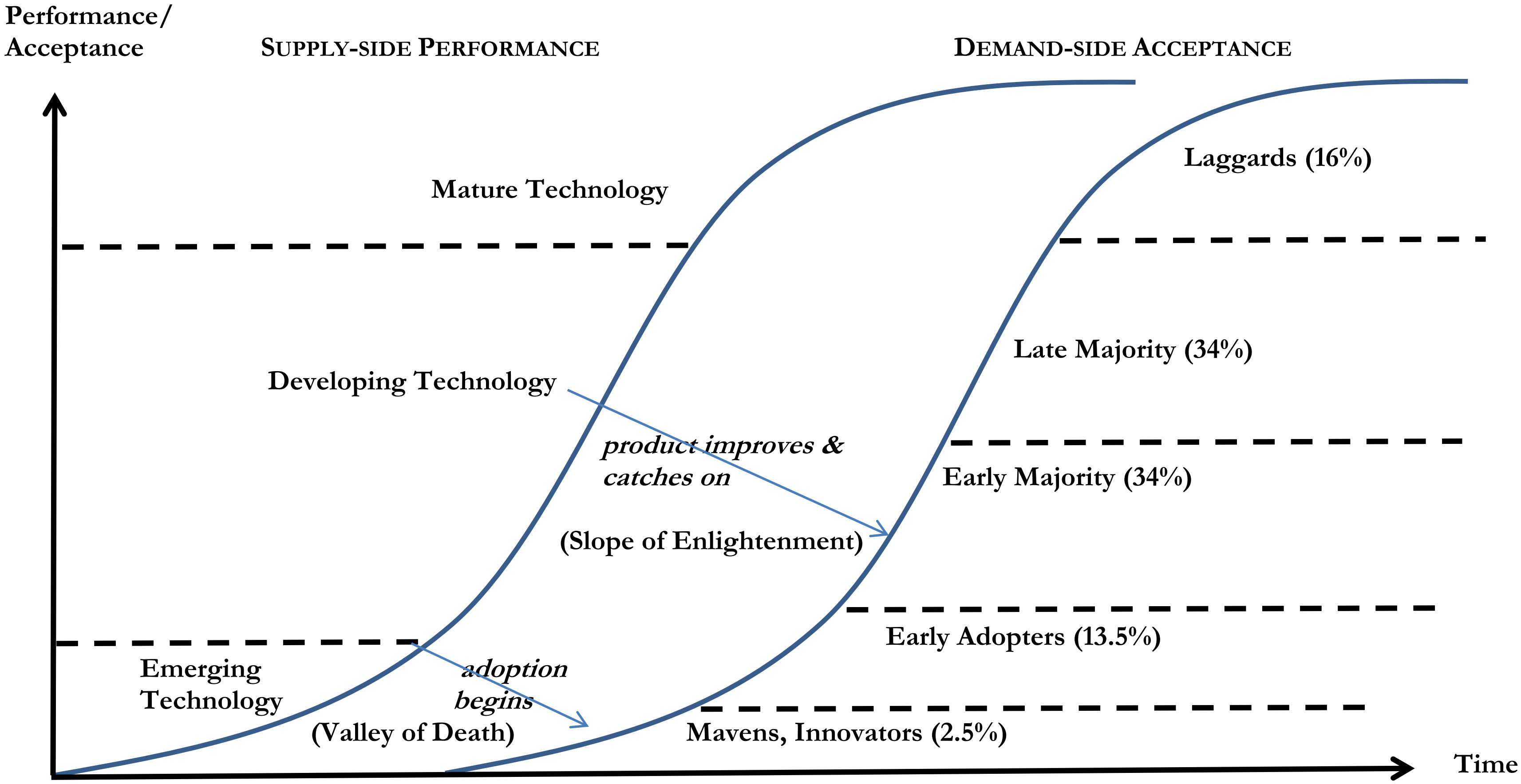
On the demand side, the process begins with initial adoption by market mavens and innovators, then spreads through early adopters, early and late majorities and finally laggards.. The adoption process accelerates rapidly with takeoff then slows with maturity. The speed and ultimate level of adoption have been primary focal points of analysis on the demand side.

The analysis of the diffusion of products has shifted its focus between the supply-side of the market and the demand side several times over the past century. The pre-World War II focus was on "”invention and innovation," but the three decades after the war focused much more on the demand side, so much so that by the 1990s, the field was criticized for ignoring the importance of the supply-side. The definition of technological diffusion offered in a 1998 review of the field, reflects this central tension.

> Technological diffusion can be defined as a mechanism that spreads successful varieties of products and processes through an economic structure and displaces wholly or partly the existing 'inferior' varieties. While the process of invention and innovation are necessary preconditions for the development of a new technology, it is the process of diffusion that determines the extent to which the new technology is being put to productive use.[3]

[1] Osawa and Miazaki, 2006.
[2] Gartner, 2013,
[3] Sarkar, 1998:131.

EXHIBIT IV-1: THE INTERACTION OF SUPPLY AND DEMAND IN THE CREATION/DIFFUSION OF INNOVATIVE TECHNOLOGIES



Source: See Mark Cooper

The bottom line in a review of the diffusion literature was a call for balance: "What is needs to be achieved in the field of diffusion research now is a *Balance* between the two archetypical modeling mechanisms of diffusion, their underlying assumptions, and the postulated modes of interaction."[4] The definition of technological diffusion offered in this review of the field, reflects this central tension.

Exhibit V-2 shows the factors that have been identified as affecting the diffusion process. The causal factors on the supply-side are shown on the upper part of the figure. The causal factors on the demand-side of the diffusion process are presented in the lower part. The literature identifies four broad categories of factors that affect adoption on the demand side: demographics, social influences, attitudes and the ability to make calculations. Because of its focus on the consumer adoption decision, the diffusion literature was very sensitive to causal factors that drive diffusion, factors that are grounded in behavioral economics including: "Perception: Type of Uncertainty, Uncertainty Model, Preference Structure: Attributes, Risk Attitude, Adoption Decision Rules: Maximize Expected Utility, Learning: Model, Sources of Information [5]

On the demand side, the assumption is that the underlying process "is a social learning process which results in consumers slowly changing their attitudes and values… some individuals change their views quicker than others; it is a "rolling snowball" phenomenon which starts with just a few people and gets bigger as it fathers momentum."[6] The demand side approach looked both at the aggregate level of penetration and the individual adoption decisions.

> [A]ttempts have been made… to develop diffusion models by specifying adoption decisions at the individual level. In these models… a potential adopter's utility for an innovation is based on his uncertain perception of the innovation's performance, value or benefits. The potential adopter's uncertain perception of the innovation, however, changes over time as he learns more about the innovation from external sources (e.g., advertising) or internal sources (e.g., word of mouth). Therefore, because of this learning, whenever his utility for the innovation becomes greater than the status quo, (he is better off with the innovation), he adopts the innovation. [7]

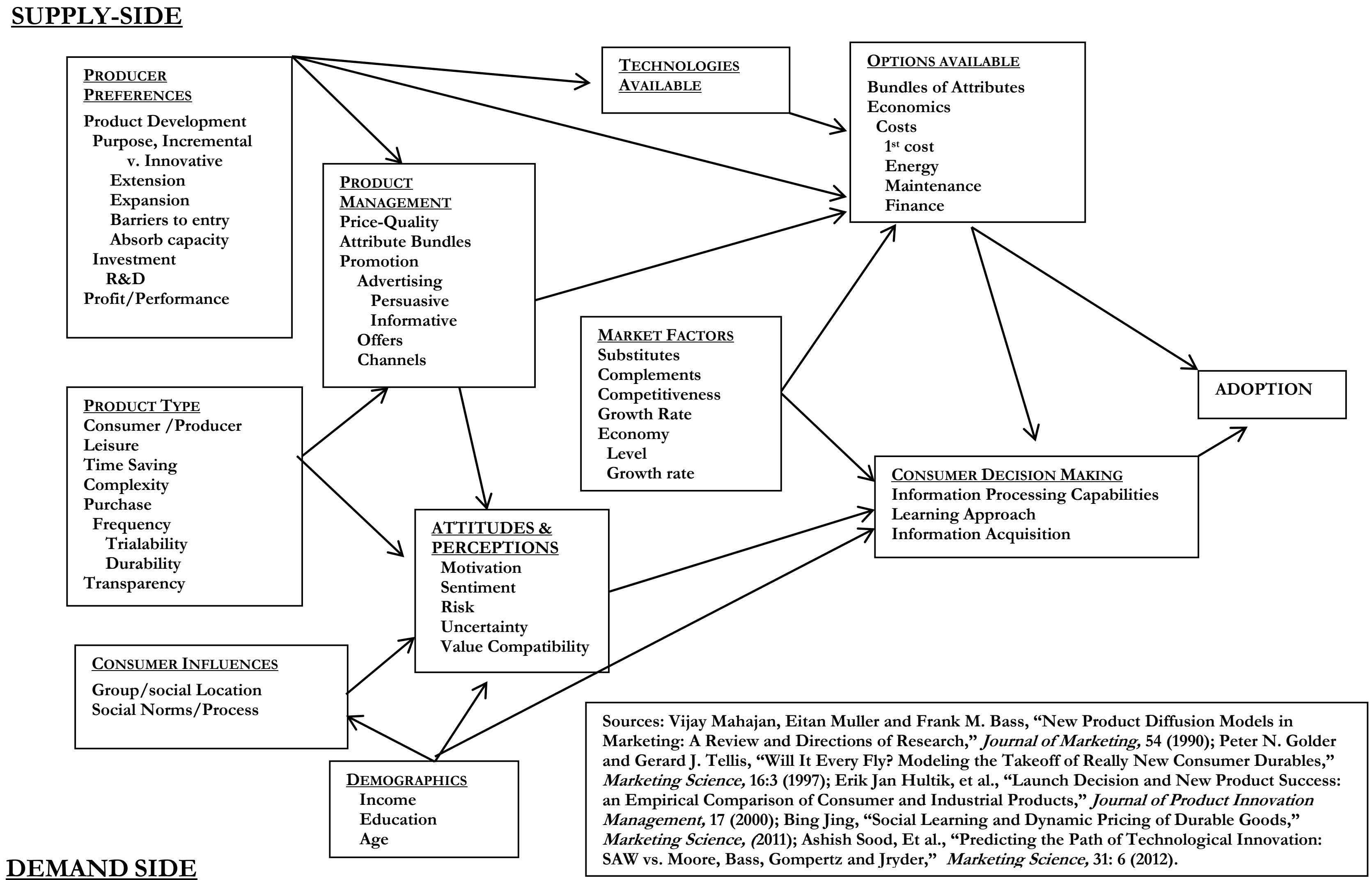
However, the challenge of diffusion is first, and foremost, a matter of supply-side innovation. To put the matter simply, consumers cannot adopt technologies until they are offered to them in the marketplace. Innovation must precede diffusion.

> Marketing literature has traditionally portrayed new product development as essentially a market/consumer-led process, but paradoxically, many, major market innovations appear in practice to be technology driven, to arise from a technology seeking a market application rather than from a market opportunity seeking a technology. This, of course, is the antithesis of the marketing concept, which is to start with the customer, then design something to meet his needs. While this may be intuitively reasonable, and indeed appropriate in a market where changes are slow and can reasonably be anticipated, it may be less appropriate in faster changing markets with higher technology content. However, for successful technology – driven market development, in addition to a technological discovery, there needs to be an element of insight as to how it should be applied… It would seem that innovation is fundamental to the strategic management of businesses,

---

[4] Sarkar, 1998:167.
[5] Mahajan, Muller and Bass, 1990: 6-7.
[6] Brown, 1992: 62.
[7] Mahajan, Muller and Bass, 1990, pp. 6-7.

EXHIBIT V-2: CAUSAL FACTORS THAT DRIVE THE SUPPLY AND DIFFUSION OF INNOVATIVE PRODUCTS



Sources: Vijay Mahajan, Eitan Muller and Frank M. Bass, "New Product Diffusion Models in Marketing: A Review and Directions of Research," *Journal of Marketing,* 54 (1990); Peter N. Golder and Gerard J. Tellis, "Will It Every Fly? Modeling the Takeoff of Really New Consumer Durables," *Marketing Science,* 16:3 (1997); Erik Jan Hultik, et al., "Launch Decision and New Product Success: an Empirical Comparison of Consumer and Industrial Products," *Journal of Product Innovation Management,* 17 (2000); Bing Jing, "Social Learning and Dynamic Pricing of Durable Goods," *Marketing Science, (*2011); Ashish Sood, Et al., "Predicting the Path of Technological Innovation: SAW vs. Moore, Bass, Gompertz and Jryder," *Marketing Science,* 31: 6 (2012).

but that it is a complex and potentially risk-laden activity… No doubt the debate over the extent to which radical innovation is caused by "technology push or by "market pull" will continue [8]

Recognition of the important of the supply-side also reflects a greater emphasis on the role of entrepreneurship and management in the innovation process because "takeoff is not instantaneous and requires patience and careful planning on the part of managers."[9] Management faces a variety of challenges in shepherding innovative technologies to business success.[10] Exhibit IV-2 emphasizes the factors that affect the supply side, by placing them at the tope of the process.

Management can have different motives for technology innovation and use different tools to increase the likelihood that the technology will achieve a large enough market to be profitable.[11] Entrepreneurs make the decisions about what technologies to develop and products to market, as well as how those products are priced, brought to market and promoted. They do so in response to their perception of the market they are located in and their understanding of consumers, as well as their own preferences. Their ability to perform these activities is neither perfect nor uniform.[12]

---

[8] Brown, 1992, p. 65.

[9] Golder and Tellis, 1997, p. 267.

[10] Golder and Tellis, 1997, p. 267. [S]ome other variable may also help explain the takeoff of new durables. Such variables include technological change, product quality, relative advantage of the new product over substitute products, availability of complementary products that increase the utility of the new product, and the number of competitors.

[11] Golder and Tellis, 1997p. 267 Increasing the rate of price reduction *increases the peak probability* of takeoff in each curve, as well as *advances the time* at which the peak occurs. Ironically, as Hultik, et al., 2000, p. 5, point out, the advice given to management in the standard texts does not reflect the findings of the analysis of innovation diffusion, "The relationship found in these data between success and launch decisions differ quite markedly from the standard normative prescriptions… None of the extensive advice provided in the normative literature on competitive or innovation strategy decisions, as found, in this research, to be associated with success. Additionally, a number of strategic objectives related to success for consumer goods were identified in this study, none of which are mentioned in the normative literature."

[12] Golder and Tellis, 1998: 263-264. "No matter how inexpensive the product is, or how high consumers' incomes are or how strong consumer sentiment is, the likelihood of purchase still increases as products become more visible and available to consumers. Widespread distribution will lead to higher market presence and will tend to increase the likelihood of new product success. Market presence reflects the opportunities that potential consumers have to observe a product. These opportunities occur in several ways. First, as sales increase, interest and excitement among consumers about a product increases… Second, as sales of a product increase, retail promotions will increase leading to enhanced visibility. Since store displays are designed to attract consumers' attention and led to sales, retailers promote products they know consumers have some interest in buying. Therefore, products capable of accomplishing this objective are those that already have a demonstrated sales record. Third, as sales increase, the number of stores carrying a product will increase leading to enhanced visibility. Once consumers begin to buy a new product, additional stores carry that product." These authors conclude that "Individual level diffusion models or models that combine economic and communications elements seem especially promising," pointing to a number of studies including Chatterjee and Eliashberg, 1990; Horky, 1990' Kalish, 1985; Lattin and Roberts, 1989. Brown, 1992: 73, "Consider, for example, the development of the market for pocket calculators… The first purchasers were engineers and scientists because they had extensive can complex calculations to perform and existing technology (the slide rule and the log table)… As the early manufacturers of calculators began to benefit from technological advances and from economies of experience and scale prices began to fall. Calculators then began to become attractive to accountants and other commercial users… Compared to engineers and scientists, accountants and commercial users have a lower utility value and could only justify purchase when the price came down… As calculator prices fell still further, so they began to become attractive to the general public. Of course, the utility value to these users was lower than to commercial users, but again the potential larger."

B. THE IMPORTANCE OF TRANSACTION COSTS AND BEHAVIORAL FACTORS

A major source of tension in the innovation diffusion field flows from the approach to modeling behavior and process: the efficient market hypothesis underlying neoclassical economics v. institutional, transaction and behavioral economics views of imperfect markets.

> The issue relates to whether the diffusion process should be formalized as [*neoclassical equilibrium*]… with diffusion patterns reflecting a sequence of shifting equilibria over time in which agents are fully adjusted…modeled as being infinitely rational and fully informed… or as a disequilibrium process… modeled as being constrained by lack of information or understanding on the part of adopters about the worth of an innovation.[13]

The dramatic difference between the approaches to the analysis of innovation diffusion are evident in the side-by-side comparison of the two dominant approaches summarized in Exhibit V-3 shows. The broad critique of the neoclassical economic model rested primarily on the fact that the underlying assumptions of infinitely rational/fully informed actors in the neoclassical model does not fit real world behaviors at all.

> As Simon stressed in his Nobel Memorial Lecture, the classical model of rationality requires knowledge of all the relevant alternatives, their consequences and the probabilities, and a predictable world without surprises. These conditions, however, are rarely met for problems that individuals and organizations face. Savage, known as the founder of modern Bayesian decision theory, called such perfect knowledge small worlds… In large worlds, part of the relevant information is unknown or has to be estimated from small samples, so that the conditions for rational decision theory are not met, making it an inappropriate norm for optimal reasoning. In a large world…one can no longer assume that "rational" models automatically provide the correct answer.[14]

EXHIBIT V-3: DECISION THEORETIC APPROACHES TO MODELING DIFFUSION

	Neoclassical Equilibrium	**Evolutionary Disequilibrium**
Scientific Analogy	**Newtonian mechanics**	**Evolutionary Biology**
Assumptions:	**Full/limited information**	**Necessarily limited-information**
	Infinite rationality	**Bounded rationality**
	Equilibrium mechanism	**Disequilibrium mechanism**
	Exogenous/endogenous	**Necessarily endogenous**
	Continuous & quantitative	**Continuous & Quantitative (Darwinian)**
		Discontinuous & qualitative (non-Darwinian)
Characteristics of the Diffusion Process	**Predictable**	**Unpredictable**
	Ahistorical	**Path-dependent (historicity)**
	Efficient	**Efficient (Darwinian)**
		Possible inefficiency (non-Darwinian)

Source: Jayati Sarkar, "Technological Diffusion: Alternative Theories and Historical Evidence, *Journal of Economic Surveys,* 2: 1998, p. 149.

---

13 Sarkar, 1998:132.

14 Gigerenzer and Gaissmaier, 2011, p. 453.

The effort to understand the complex influences on human behavior has moved well beyond the simple "rational v. irrational" dichotomy.[15] The middle ground recognizes that "intelligent choice," "useful inferences" and "smart" decisions are possible without reference to "the classic model of rationality."[16] "Ecological rationality" is a term applied to this middle ground that recognizes the limitations imposed on choice by the environment and the capacity of individuals to make decisions.

> The study of ecological rationality is related to the view that human cognition is adapted to its past environment. [17]
>
> In a complex and uncertain world, humans draw inferences and make decisions under the constraints of limited knowledge, resources, and time…. These heuristics perform well because they are ecologically rational: they explore the structure of environmental information and are adapted to this structure.
>
> Models of ecological rationality describe the structure and representation of information in actual environments and their match with mental strategies, such as bounded rational heuristics. (8) The simultaneous focus on the mind and its environment, past and present, put research on decision making under uncertainty into an evolutionary and ecological framework, a framework that is missing in most theories of reasoning, both descriptive and normative.[18]

If the baseline assumption of infinite rationality and full information is as far from reality as this discussion suggests, it is reasonable to argue that the baseline should shift to a set of assumptions that are closer to reality. This would make it more likely that the model will avoid the error of assuming that a little more information fed into a context where the underlying forces are almost right will solve the problem. It will avoid the Mercatus Center mistake.[19]

Recognizing the environmental and cognitive constraints on decision making shifts the focal point of the analysis to internal criteria of performance. The focus of study shifts to the origin and impact of constraints on decision making and the tools humans use to make decisions under those constraints.

> Within ecological rationality it is of utmost importance to look at how the environment influences

---

[15] However, stepping back from the assumption of perfect rationality can lead to an overemphasis on the irrational, or error in decision making. Hoffrage and Reimer, 2004, p. 456 "[H]euristics were invoked as explanation for systemic errors found in human reasoning – mainly deviation from the laws of probability. Although Tversky and Kahneman repeatedly asserted that heuristics sometimes succeed and sometimes fail, they and many of their colleagues focused on the latter category and interpreted their experimental findings as indicating some kind of fallacy…."

[16] Hoffrage and Reimer, 2004, p. 456, "Fast and frugal heuristics, in contrast, are not associated with the value laden term bias. On the contrary, by taking advantage of the structure of information in the environment, these heuristics can lead to accurate and useful inferences; hence they do not necessarily lead to biases but they can "make us smart." Gigerenzer and Gaissmaier, 2011, p. 473 quoting James March [I]f behavior that apparently deviates from standard procedures of calculated rationality can be shown to be intelligent, then it can plausibly be argued that models of calculated rationality are deficient not only as descriptors of human behavior but also as guides to intelligent choice.

[17] Gigerenzer and Gaissmaier, 2011, 2011, pp. 457-458.

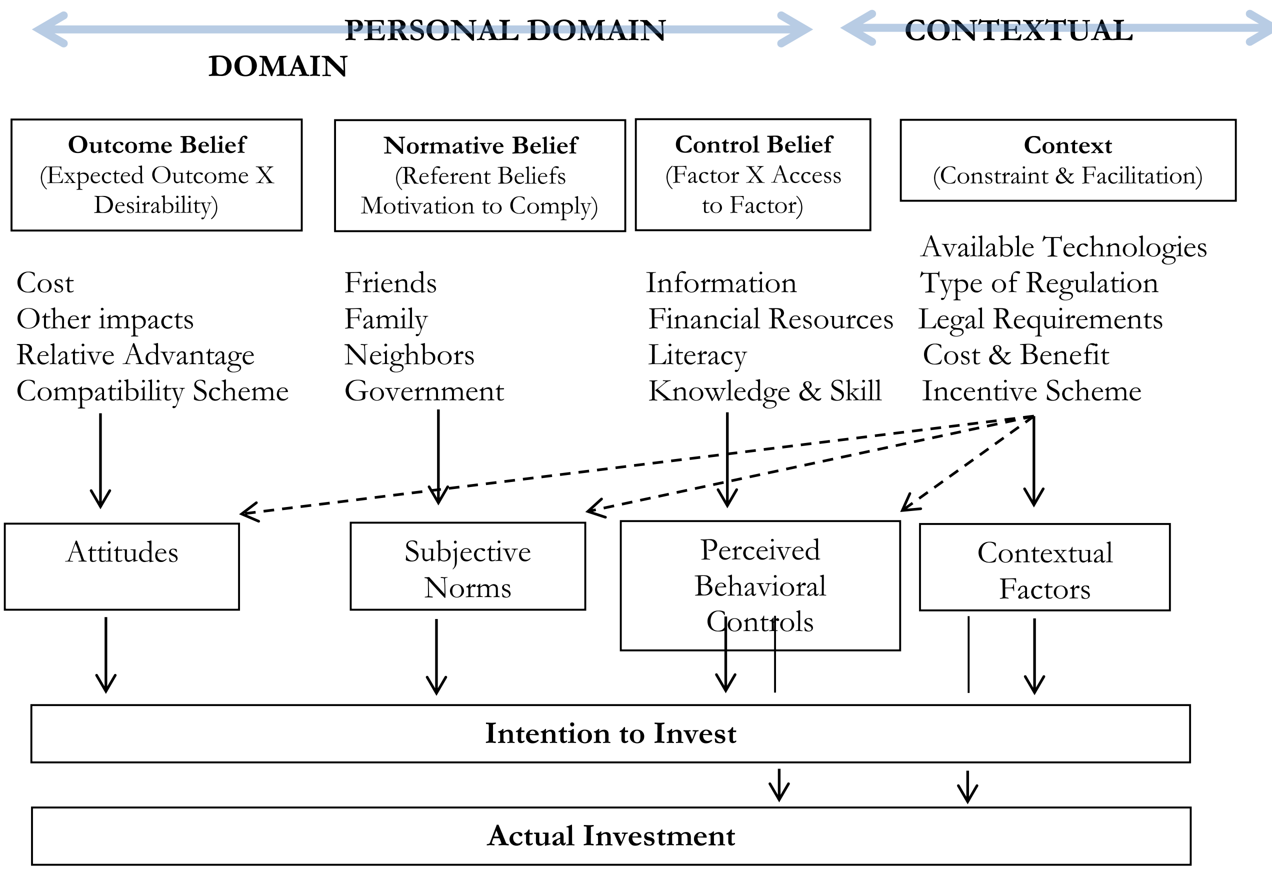
[18] Hoffrage and Reimer, 2004, p. 442 cited in Basel and Bruhl, 17-1; Hoffrage and Reimer, 2004, p. 443.

[19] From such a perspective it is straightforward to study the adaptation of mental and social strategies to real-world environments rather than compare strategies to the norms of probability theory (e.g., *Bayes's rule*, which can be used to update prior beliefs in the light of new data) and logic (e.g., the *conjunction rule*, according to which the probability that an object belongs both to the classes A and B cannot exceed the probability that it belongs to class A). Rather, the performance of a heuristic is evaluated against a criterion that exists in the environment – the distinction between internal consistency versus external correspondence Hoffrage, and Reimer, 2004, p. 437

the tasks and how the environment shapes and has shaped the cognitive capacity of social actors. Humans have an evolutionary past in which they constantly learned and adapted to biological and social environment and this shaped their cognitive capacities… In addition, humans are not error free and, even more importantly; they face a wide range of tasks in a modern technological environment.[20]

Exhibit V-4 presents a common framing of the behavioral considerations. In our earlier analysis, we have identified three broad categories of concepts from the behavioral economics literature that are roughly equivalent to those in Exhibit V-4:

EXHIBIT V-4: INTEGRATED MODEL TO EVALUATE DETERMINANTS OF TECHNOLOGY UPTAKE



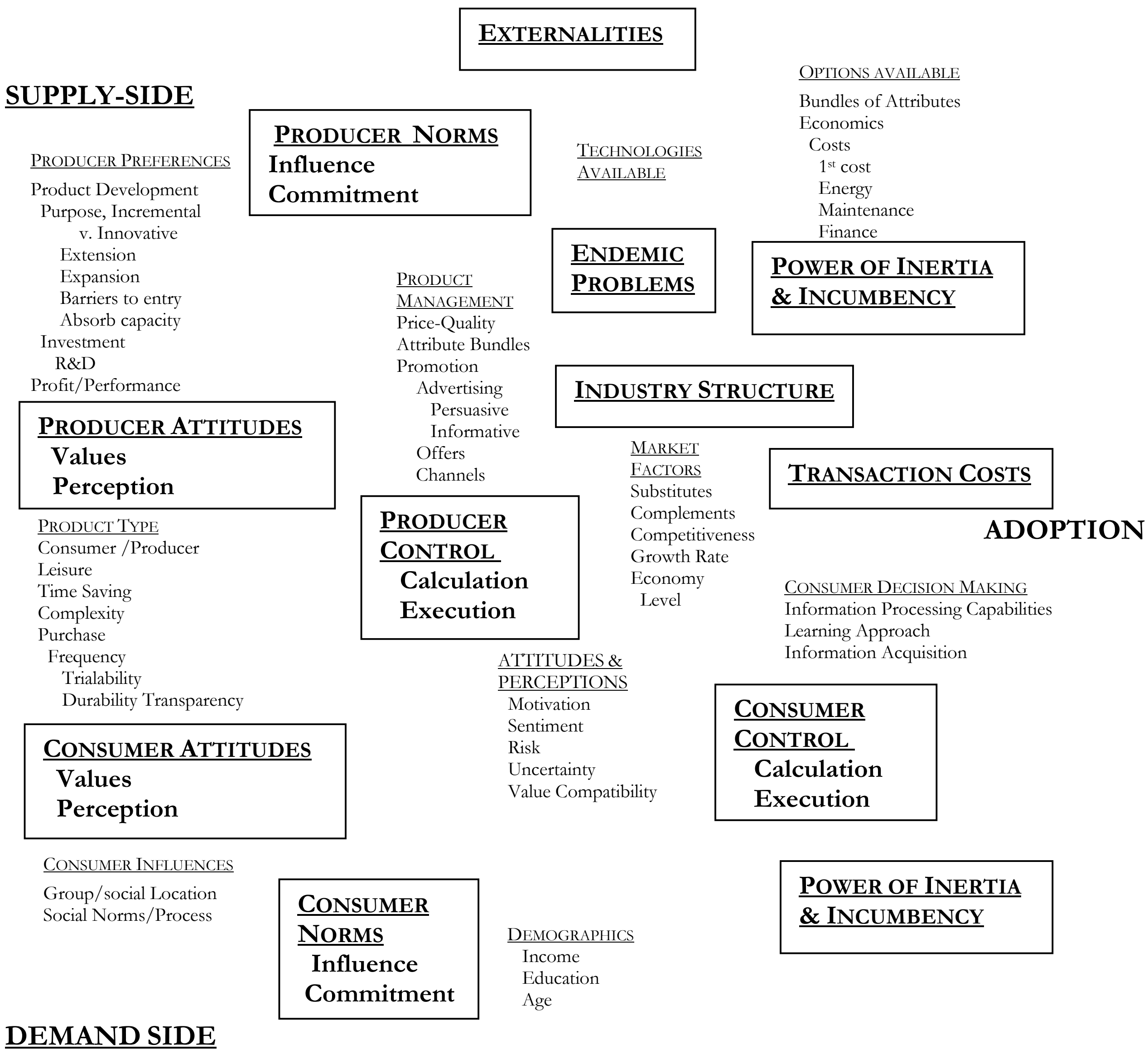
Source: Marius Claudy and Aidan O'Driscoll, "Beyond Economics: A Behavioral Approach to Energy Efficiency in Domestic Buildings," ***Dublin Institute of Technology*****, 2008; based on Stern, Paul C., "Towards a Coherent Theory of Environmentally Significant Behavior,** ***Journal of Social Issues,*** **56: 2000; see also, Charlie Wilson and Hadi, Dowlatabadi, "Models of Decision Making and Residential Energy Use,** ***Annual Review of Environmental Resources,*** **32:2007, p. 183.**

[20] Basel and Bruhl, 2011, p. 19.

C. THE INTERSECTION MARKET BARRIERS AND THE INNOVATION DIFFUSION PROCESS

Exhibit IV-5 locates impediments to diffusion in the broad categories of market failure identified in in the "efficiency gap" analysis of Section II. We locate the barriers and imperfections at different points in the flow of innovation/diffusion. We include the three major types of behavioral factors on both the supply-side and the demand side. Arguably, the supply-side is less affected by these factors, since the assumption of profit (welfare) maximizing economic enterprises fits the supply-side better. However, the fit is certainly not perfect and several of the barriers that we observe on the supply-side, like status quo bias and internal structural constraints fit in the behavioral arena. We also include the power of inertia and incumbents on both the supply and demand sides of the market.

EXHIBIT IV-5: MARKET BARRIERS AND IMPERFECTIONS AND THE CAUSAL FACTORS THAT DRIVE THE SUPPLY AND DIFFUSION OF INNOVATION



The central questions in the efficiency gap analysis involve the process of the adoption of new technologies. Treating the efficiency gap as a special case of the diffusion of innovations allows us to draw on the much broader study of the factors that affect the speed with which technologies are developed and sold to the public. By examining some of the key themes and developments in innovation diffusion literature, we deepen the understanding of the efficiency gap.

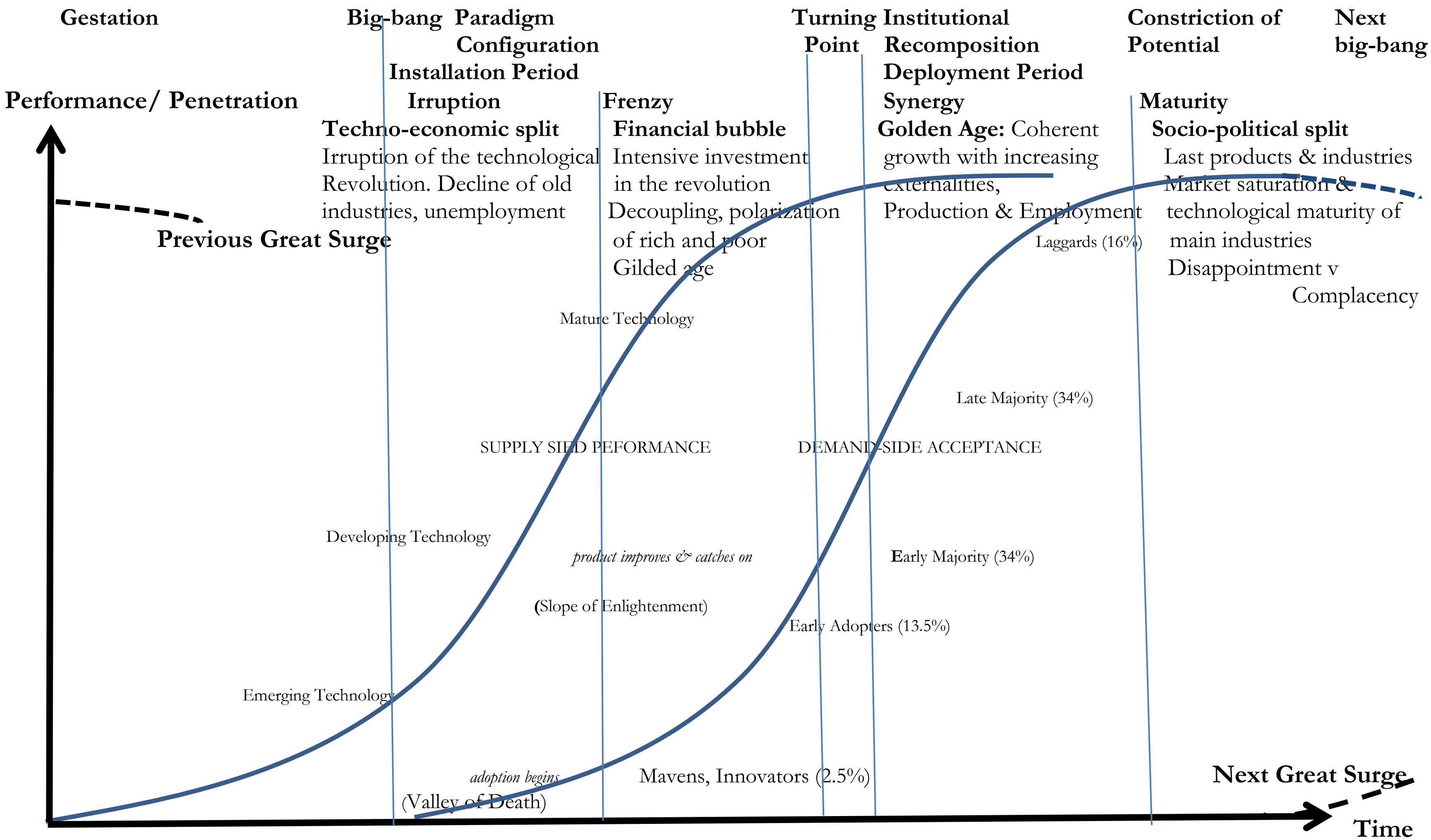
- The literature emphasizes the importance of the supply-side, which does not receive sufficient attention in the efficiency gap literature because of the focus on consumer behavior.
- The literature identifies the factors that account for slow innovation and diffusion on both the supply and demand sides of the market.

The innovation diffusion literature exhibits concerns about factors that affect adoption that are similar to the market imperfections and barriers identified in the efficiency gap literature.

D. TECHNOLOGY REVOLUTION AS DIFFUSION

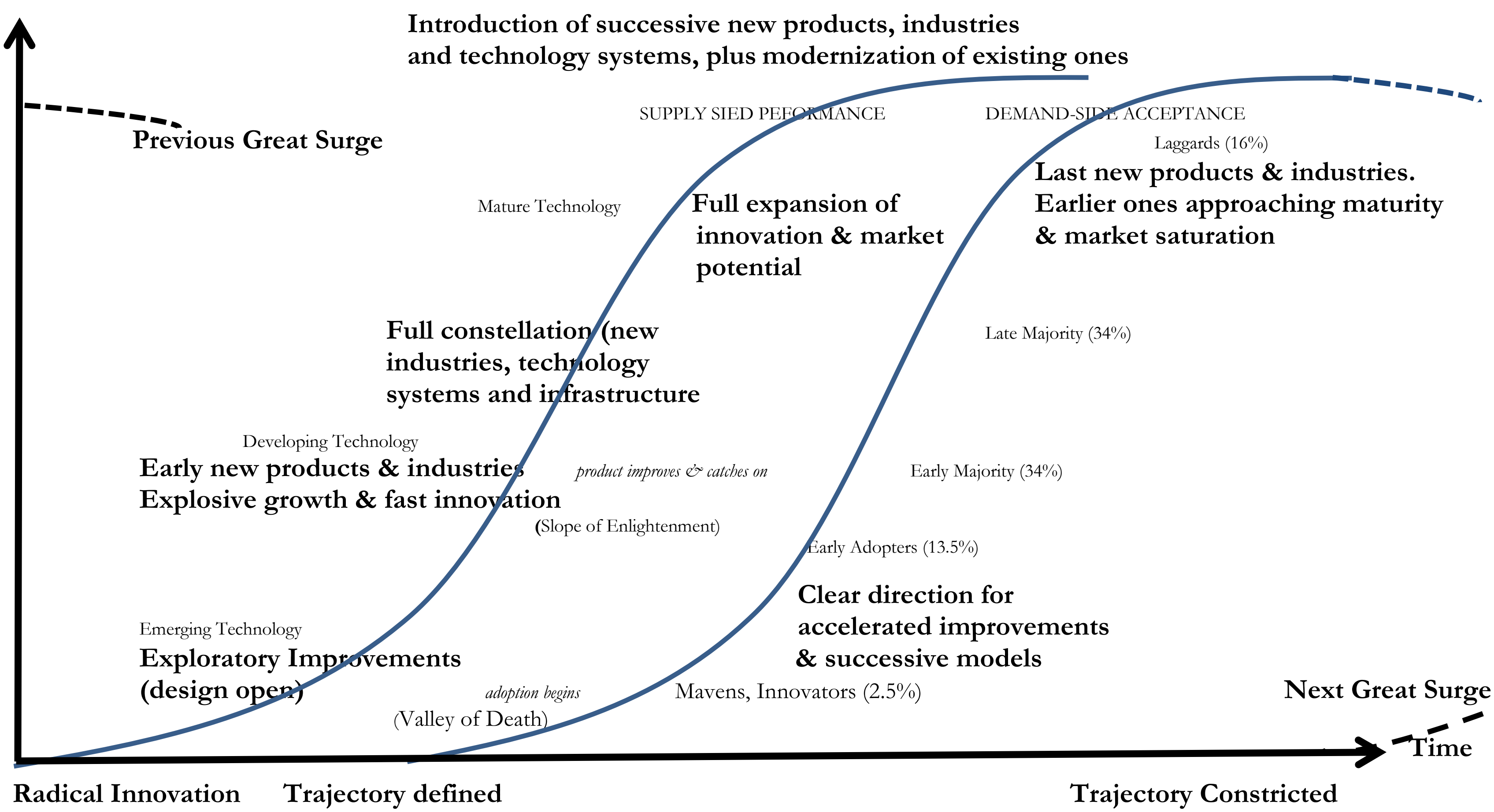
Exhibits IV-6 and IV-7 overlay the diffusion curves from Perez's technology stage analysis on the innovation diffusion curves discussed in this section. Although the diffusion curves deal with products, rather than the entire economy there is a strong similarity.

FIGURE III-1: STAGES IN THE LIFE CYCLE OF TECHNOLOGICAL REVOLUTIONS



Source: Carlota Perez, *Technological Revolutions and Finance Capital* (Edward Edgar, 2002), Figures 3.1, 4.1, 14.1.

FIGURE III-1: PROCESSES IN THE LIFE CYCLE OF TECHNOLOGICAL REVOLUTIONS



Source: Carlota Perez, *Technological Revolutions and Finance Capital* (Edward Edgar, 2002), Figures 3.1, 4.1, 14.1; *Financial bubbles, crises and the role of government in unleashing golden ages*, FINNOV, January 2012, Figure 1.

COMPREHENSIVE EXPLANATIONS OF THE EFFICIENCY GAP AND THE INTERSECTION OF THE EFFICIENTY GAP AND CLIMATE CHANGE LITERATURES

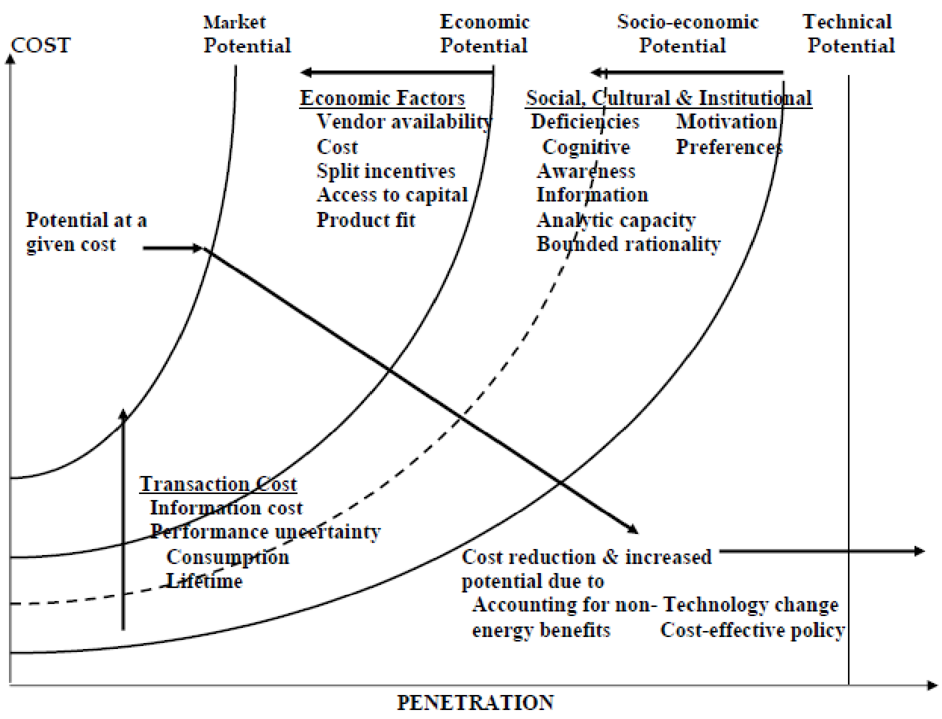
ENERGY EFFICIENCY PERFORMANCE STANDARDS: The Cornerstone of Consumer-Friendly Energy Policy, October 2013

This section presents a comprehensive analytic framework that explains the energy efficiency gap by examining several frameworks that have been developed over the past two decades. These frameworks rest upon a strong foundation of empirical analysis that has been developed over more than a quarter of a century and strengthened considerably in the past decade. After developing the overall framework, we review the recent empirical evidence that supports key pieces of the framework.

A. THE LBL FRAMEWORK

An analytic framework that rests on a technology investment approach was offered by analysts at Lawrence Berkeley National Laboratory (LBL). As shown in in Exhibit II-1, one can use a technology investment framework to assess the factors that cause investment in energy efficiency to fall well short of the technical potential.

EXHIBIT II-1: PENETRATION OF MITIGATION TECHNOLOGIES: A CONCEPTUAL FRAMEWORK



Source: Jayant Sathaye and Scott Murtishaw, ***Market Failures, Consumer Preferences, and Transaction Costs in Energy Efficiency Purchase Decisions*** **(California Energy Commission, November 2004), p. 11.**

The LBL study identified broad categories of market imperfections, barriers, and obstacles that are important in determining the level of investments – economic, transaction cost, and social cultural and institutional. The analysis emphasizes the important role that policy can play in determining where the market will settle. Thus, there are six broad categories of factors that must be incorporated into the analysis of the level of investment in energy saving technologies. Market performance is influenced by:

- behavioral factors (social, cultural & institutional)
- economic factors
- transaction costs
- externalities (non-energy costs)
- technological change
- public policy

Exhibit II-2 summarizes an earlier 1996 paper prepared by other analysts at the LBL.[1] Exhibit A-II-2 provides citations. The analysis was framed in terms of the role of policy intervention to promote efficiency as states restructured the electricity market. The paper "focuses on understanding to what extent some form of future intervention may be warranted and how we might judge the success of particular interventions."[2] Restructuring did not spread throughout the utility industry and in the past few years, reliance on interventions in the market to increase efficiency and renewables has grown, even in the deregulated states.[3] The growth of market interventions is consistent with the conclusions in the LBL paper.

> We conclude that there are compelling justifications for future energy-efficiency policies. Nevertheless, in order to succeed, they must be based on a sound understanding of the market problems they seek to correct and a realistic assessment of their likely efficacy.[4]

EXHIBIT II-2: MARKET BARRIERS TO ENERGY EFFICIENCY

Barriers[1]	**Market Failures**	**Transaction Cost[2]**	**Behavioral factors[16]**
Misplaced incentives	Externalities	Sunk costs[3]	Custom[17]
Agency[4]	Mis-pricing[20]	Lifetime[5]	Values[18] & Commitment[19]
Capital Illiquidity[8]	Public Goods[22]	Risk[6] & Uncertainty[7]	Social group & status[21]
Bundling	Basic research[23]	Asymmetric Info.[9]	Psychological Prospect[24]
Multi-attribute	Information	Imperfect Info.[10]	Ability to process info[27]
Gold Plating[11]	(Learning by Doing)[25]	Availability	Bounded rationality[26]
Inseparability[13]	Imperfect Competition/	Cost[12]	
Regulation	Market Power[28]	Accuracy	
Price Distortion[14]			
Chain of Barriers			
Disaggregated Mkt.[15]			

William H. Golove and Joseph H. Eto, *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency.* For citations, see Appendix A, Exhibit A-II-2

As shown in Exhibit II-2, the Golove and Eto paper identified four broad categories of factors that inhibited investments in energy efficiency – barriers, transactions costs, market failures, and

---

[1] Golove and Eto, 1996.

[2] Golov and Eto, 1996, p. iv.

[3] There has recently been a dramatic re-commitment to publicly-sponsored energy efficiency and a substantial increase in allocated resources, Sanstad, Hanemann and Auffhammer, 2006, p. 6-5.

[4] Golove and Ito, 1996, p. x.

behavioral (noneconomic) factors. It identifies about two dozen specific factors spread roughly equally across these four categories. A key aspect of the analysis is to identify each of the categories as coming from a different tradition in the economic literature. The barriers category is made up of market structural factors. The market failure category is made up of externalities and imperfect competition. The LBL paper bases a substantial part of its argument on a transaction cost perspective as a critique of neo-classical economics.

> Neo-classical economics generally relies on the assumption of frictionless transactions in which no costs are associated with the transaction itself. In other words, the cost of activities such as collecting and analyzing information; negotiating with potential suppliers, partners and customers; and risk are assumed to be nonexistent or insignificant. This assumption has been increasingly challenged in recent years. The insights developed through these challenges represent an important way to evaluate aspects of various market failures (especially those associated with imperfect information).[5]

Starting from the observation that "transaction costs are not insignificant but, in fact, constitute a primary explanation for the particular form taken by many economic institutions and contractual relations"[6] the LBL paper identifies such costs and information as a critical issue, pointing out that "the key issue surrounding information is not its public goods character, but rather its asymmetric distribution combined with the tendency of those who have it to use it opportunistically."[7] Indeed, information plays a very large role in the analysis, entering in six different ways. In addition to the public goods and asymmetry concerns, the paper identifies four other ways information can create a barrier to efficiency –"(1) the lack of information, (2) the cost of information, (3) the accuracy of information, and (4) the ability to use or act upon information."[8]

C. THE RFF FRAMEWORK

A more recent paper from Resources for the Future (RFF), entitled *Energy Efficiency Economics and Policy,* addresses exactly the same issues as the earlier LBL paper – the debate over the efficiency gap observed in energy markets. The authors of the RFF paper characterize the efficiency gap debate as follows:

> Much of the literature on energy efficiency focuses on elucidating the potential rationales for policy intervention and evaluating the effectiveness and cost of such interventions in practice. Within this literature there is a long-standing debate surrounding the commonly cited "energy efficiency gap..." Within the investment framework… the energy efficiency gap takes the form of under investment in energy efficiency relative to a description of the socially optimal level of energy efficiency. Such under investment is also sometimes described as an observed rate or probability of adoption of energy-efficient technologies that is "too slow."[9]

The RFF framework is summarized in Exhibit II-3. Exhibit A-II-3 provides citations. Exhibit II-3 is taken from the RFF paper, but extended in two ways. In the market failure category, it shows the distinction between the structural and societal levels suggested by the paper. It also includes a few

---

[5] Golove and Eto, p. 22.
[6] Golove and Eto, p. 23.
[7] Golove and Eto, p. 23.
[8] Golove and Eto, p. 20.
[9] Gillingham, Newell and Palmer, p. 7.

more specific failures that were discussed in the text, but not included in the original table. There are about a dozen specific market failures spread across these categories.

EXHIBIT II-3: MARKET AND BEHAVIORAL FACTORS RELEVANT TO ENERGY EFFICIENCY

Societal Failures	***Structural Failures***	***Potential Behavioral Failures***[11]
Energy Market Failures	Capital Market Failures	Prospect theory[12]
Environmental Externalities[1]	Liquidity constraints[5]	Bounded rationality[13]
Energy Security	Information problems[6]	Heuristic decision making[14]
Innovation market failures	Lack of information[7]	Information[15]
Research and development spillovers[2]	Asymmetric info. >	
Learning-by-doing spillovers[3]	Adverse selection[8]	
Learning-by-using[4]	Principal-agent problems[9]	
	Average-cost electricity pricing[10]	

Source: Kenneth Gillingham, Richard G. Newell, and Karen Palmer, *Energy Efficiency Economics and Policy* (Resources for the Future, April 2009). For Citations, see Appendix A, Exhibit A-II-3

The RFF paper suggests three broad categories of market failures – the individual, the interaction between economic agents and the fit between economic agents and society. We refer to these three levels as the behavioral, the market structural and the societal levels. In the present context, we consider behavioral failures to represent consumer behavior that is inconsistent with utility maximization, or in the current context, energy service cost-minimization. In contrast, market failure analysis is distinct in presupposing individual rationality and focusing on the conditions surrounding interactions among economic agents and society.[10] The societal level market failures are closest to what the traditional sources of the economic literature refers to as market failure. These are primarily externalities and public goods. These were also considered market failures in the LBL framework. The LBL barriers and transaction costs fit in the category of interactions between economic agents, as would imperfect competition.

One obvious point is that, once again, information problems occur in all categories of the RFF analysis, with several manifestations in each. Information can be a problem at the societal level since it can be considered a public good that is not produced because the authors of the information cannot capture the social value of information. It is a structural problem because, where it is lacking, even capable, well-motivated individuals cannot make efficient choices. Finally, where it is asymmetric, individuals can take advantage of the less informed to produce outcomes that are not efficient. It is a problem at the behavioral level where individuals lack the ability to gather and process information.

D. OTHER RECENT COMPREHENSIVE EFFICIENCY GAP FRAMEWORKS

In the past few years, several comprehensive reviews have been offered that attempt to depict the many diverse factors that underlie the efficiency gap.

The United Nations Industrial Development Organization

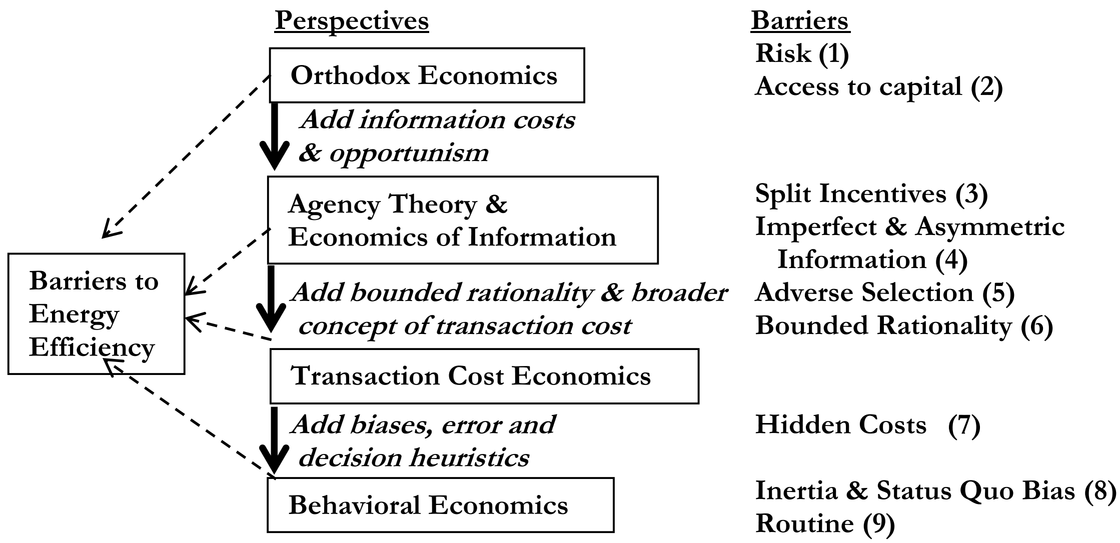
Exhibit II-4 summarizes a recent comprehensive review of the causes of the efficiency gap in industrial sectors across the globe. Exhibit A-II-4 provides citations. It is based on a conceptualization and analysis prepared for the United Nations Industrial Organization by analysts at universities in the

---

[10] Id., p. 8.

United Kingdom (hereafter UNIDO). It is based on a review of over 160 studies of barriers to energy efficiency in industrial enterprises.

EXHIBIT II-4: BARRIERS TO INDUSTRIAL ENERGY EFFICIENCY



Steve Sorrell, Alexandra Mallett & Sheridan Nye. *Barriers to industrial energy efficiency, A literature review,* United Nations Industrial Development Organization, Vienna, 2011, Figure 3.1 & Section 3. For citations, see Appendix A, Exhibit A-II-4.

It can be argued that the analysis of industrial sectors provides the most compelling evidence that an energy efficiency gap exists, since these are contexts in which the incentive to adopt economically rational technologies should be strong, if not pure, and the knowledge and ability to evaluate alternatives should be greater than society at large. Moreover, since energy is a cost of doing business, records and data should be superior to the residential sector, so evaluation and calculation should be better. In spite of these factors pointing toward economic rationality, and notwithstanding assumptions of motivation and capability, these authors find solid empirical evidence that the efficiency gap exists.

As was the case in the LBL analysis, the UNIDO analysis identified a school of economic thought that can be closely associated with each of the categories of market barriers and imperfections. The broad categories in the UNIDO analysis match up well with the perspectives offered by LBL and RFF with the addition of the category of externalities. The UNIDO document offers six broad types of barriers, with two dozen subtypes.

Exhibit II-7 lists the full array of market failures, barriers and imperfections that cause the underinvestment in energy saving technologies derived from the conceptual discussion above. It identifies the individual problems that the recent empirical literature observed in the energy market. Citations are provided in Appendix A, Exhibit A-II-7.

Embedded in the literature reviews for each of the recent studies are citations to earlier empirical studies that provide the context for the more recent research. All of the failures, barriers and imperfections have been supported in the empirical literature, which is why they have been recognized in the conceptual frameworks. We will not review all the many studies that support each problem. Here we summarize several important, repeated broad themes.

EXHIBIT II-7: RECENT EMPIRICAL EVIDENCE ON MARKET FAILURES, BARRIERS AND IMPERFECTIONS

TRADITIONAL ECONOMICS & INDUSTRIAL ORGANIZATION

Externalities
- Public goods[1] & Bads[2]
- Basic research
- Network effects
- Information as a public good
- Learning-by-doing & Using[9]

Industry Structure
- Imperfect Competition
  - Concentration[13]
  - Barriers to entry
  - Scale[18]
  - Switching costs[20]
- Technology[23]
  - R&D
  - Investment[25]
- Marketing
  - Bundling: Multi-attribute[26]
  - Substitutes[27]
- Cost-Price
  - Limit impact of price[29]
    - Fragmented Mkt.[30]
    - Limited payback[31]

Regulation
- Price[34]
  - Infrequent
  - Aggregate, Avg.-cost[35]
- Lack of commitment[36]

NEW INSTITUTIONAL ECONOMICS

Endemic Imperfections
- Asymmetric Info[3].
- Agency[5]
- Adverse selection[6]
- Perverse incentives
- Lack of capital[10]

TRANSACTION COST
- Search and Information
- Imperfect info[14]
  - Availability[16]
  - Accuracy
  - Search cost[21]
- Bargaining
  - Risk & Uncertainty[24]
  - Liability
- Enforcement
- Sunk costs
- Hidden cost[28]

Political Power
- Power of incumbents to hinder alternatives
- Monopolistic structures and lack of competition
- Importance of institutional support for Alternatives[32]
- Inertia[33]

BEHAVIORAL ECONOMICS

Motivation & Values
- Non-economic[4]

Influence & Commitment
- Custom[7]
- Social group & status[8]

Perception
- Bounded Vision/Attention[11]
- Prospect[12]

Calculation.
- Bounded rationality[15]
- Limited ability to process info[17]
- Heuristic decision making[19]
- Discounting difficulty[22]

See Appendix A Exhibit A-II-7 for citations.

Positive Externalities

There is a very large literature on the externalities associated with energy consumption. Importantly, it goes well beyond the negative national security and environmental externalities, which are frequently noted in energy policy analysis. The macroeconomic effects of energy consumption and energy savings are important externalities of the efficiency gap.

There are two macroeconomic effects that have begun to receive a great deal of attention – multipliers and price effects. These will be discussed in greater length in the next section, as they belong in the cost benefit analysis as a substantial benefit. They can be briefly described as follows. Reducing energy consumption tends to reduce economic activities that have relatively small multipliers (especially when energy imports are involved as in the transportation sector) and increase economic activities that have large multipliers (including the direct effects of spending on technology and the indirect effect of increased household disposable income).

A second set of externalities that receives considerable attention is the effect of learning that can be stimulated by a performance standard that pushes firms to make investments they would not have made without the presence of the standard. This will be discussed in the next section, since it affects the cost side of the cost-benefit calculation.

Information and Behavior

Consumers and producers are poorly informed, influenced by social pressures and constrained in their ability to make the calculations necessary to arrive at objectively efficient decisions. Consumers and producers apply heuristics that reflect rationality that is bounded by factors like risk and loss aversion. Inattention to energy efficiency is rational, given the magnitude, variability and uncertainty of costs, as well as the multi-attribute nature of energy consuming durables. Consumers are influenced by social norms and advertising.

The product is a bundle of attributes in which other traits are important and energy costs are hidden costs. The resulting energy expenditures are important components of total household spending. Important benefits of energy consuming durables may be "shrouded" in the broader multi-attribute product.

Market Structure and Transaction Costs

Uncertainties about the nature of the market and the value and cost of technology and limitations of technological expertise and information play an important role, increasing the cost and raising the risk of adopting new technologies.

As a result of these factors, the marketplace yields a limited set of choices because producers and consumers operate under a number of constraints. Split incentives flowing from the agency problem are a frequently analyzed issue. When the purchaser of the energy consuming durables and the users are different people, inefficient choices result.

The market exhibits a high "implicit" discount rate, which we interpret as the result of the many barriers and imperfections that retard investment in efficiency enhancing technology. There are several aspects of the high discount rate that deserve separate attention. There is a low willingness to pay and a low elasticity of demand.

V. THE INTERSECTION OF THE EFFICIENTY GAP AND CLIMATE CHANGE LITERATURES

A. THE CENTRAL ECONOMIC DEBATE IN THE CLIMATE POLICY ARENA

A recent exchange in *Energy Economics* provides a direct link from the climate change debate to the central issue of the market imperfection/barrier framework. It was set up as a debate between William Nordhaus and Jon Weyant who offered contrasting points of view, with Roger Noll commenting.

Exhibit V-1 summarizes the market barriers and imperfections identified in the exchange between Nordhaus, Weyant and Noll. It sorts the specific barriers into six generic categories that we have identified in the literature of several sectors, including the energy sector. Sometimes the exception proves the rule.[11] That is the case when the exception is rare and demonstrates the robustness of the rule's underlying assumption. However, when the exceptions are numerous and important, they are more likely to consume the rule than prove it.[12]

EXHIBIT V-1: MARKET BARRIERS & IMPERFECTIONS: NORDHAUS, WEYANT AND NOLL

SOCIAL EXTERNALITIES	MARKET STRUCTURE	TRANSACTION COSTS
Sufficiently high & "right" price on the externality	Large Scale	Uncertainty
Other externalities	Oligopolistic structure	Risk
Research & Development	Regulation	Information
Non-profit	**ENDEMIC PROBLEMS**	Lack
Private Appropriability	Asymetrric (Strategically Withheld) Information	Difficulty
Process innovation	Principle Agent problems	**BEHAVIORAL**
Transparency of innovation	Lack of financing opportunities	Consumer Decision Making Limitations
Institutional innovation	Insufficient incentive to make optimal investment	Knowledge
Network Effects	**POLITICAL**	Time
Global Connections	Incumbent incentives to delay	Calculation
	Political inability to sustain tax	

Nordaus' defense of what he calls the "price fundamentalism" approach to climate change analysis and policy making concedes a long list of exceptions to "price fundamentalism" that are seen as extremely important by a growing number of energy analysts.

> Getting the price of carbon right is fundamentally important for stimulating innovations in technologies to mitigate global warming. The major necessary condition for ensuring that climate friendly innovation occurs is that the price of carbon is sufficiently high…Under very limited conditions, setting carbon prices to reflect the damages from carbon emission is also a sufficient

[11] Wikipedia, "Scientific sense: A case may appear at first sight to be an exception to the rule. However, when the situation is examined more closely, it is observed that the rule does not apply to this case, and thus the rule is shown to be valid after all." http://en.wikipedia.org/wiki/Exception_that_proves_the_rule

[12] Wikipedia, The statement may also be an argument that the initial rule is flawed, and instead the exception should be the rule….: "Exception that was successful enough to create a new rule or prove the assumed rule was flawed". It could also be argued the rule simply changed." http://en.wikipedia.org/wiki/Exception_that_proves_the_rule

condition for the appropriate innovation to be undertaken in market-oriented sectors. This conclusion, which I have labeled "price fundamentalism," must be qualified if the price is wrong and for those parts of research that are not profit-driven (particularly basic research), and when energy investments have particular burdens such as networking or large scale…

If the environmental externality is mispriced, the marginal social return to green investment will be misaligned with those in normal industries…

Technology policy may not optimally internalize the innovation spillovers. This may occur because appropriability differs across sectors and technologies and perhaps even within technologies. It is clear that appropriability is low for fundamental research. Some economists believe that appropriability is low for process (as opposed to product) innovations, transparent (as opposed to easily hidden) innovations, administrative or institutional (as opposed to production) innovations, and networked (as opposed to stand-alone) innovations…

A final important qualification is that this analysis applies primarily to research that is profit-oriented… One issue involves sectors that have a substantial component of not-for-profit research…A second important question is where government should draw the line between areas that are viewed as appropriate for not-for-profit support and those that are governed by the market...

Most other possible qualifications turn out to be specific applications of one of the first three.

[Qualification 1]… Energy production has many other externalities… Energy technology has a particularly global dimension.

[Qualification 2]… Green innovations have important network characteristics… Green innovations require especially large investments (or involve a large component of basic research, or have great inertia)… Outcomes of energy research are highly uncertain.[13]

What Nordhaus calls qualifications are frequently called market imperfections or barriers. Weyant starts with the R&D imperfection.

This lack of "appropriability" of the benefits of one's own innovation creates a strong motivation for public support of R&D. Such support augments the extent to which simply increasing the price of clean energy relative to that of dirty energy induces innovation. A number of studies… estimate the social rate of return for innovation expenditures at approximately double the rate of return on private R&D expenditures… a close look at the energy sector industries and their potential entrants leads to the conclusion that they are industries where appropriability is difficult.[14]

However, Weyant elaborates on and goes well beyond the list of qualification offered by Nordhaus. He sees several additional supply-side problems.

A close look at the energy industries and their potential entrants leads to the conclusion that… entry is risky and expensive, market organization is more likely to be oligopolistic than perfectly competitive, and information is strategically held and difficult to obtain…

Further complicating matters, existing companies in energy-related industries --- those that produce energy, those that manufacture the equipment that produces, converts and uses energy, and those that distribute energy – can have substantial incentives to delay the introduction of new technologies. This can happen if their current technologies are more profitable than the new ones that might be (or have been) invented, or if they are in explicitly (oil and gas) or implicitly (electric generation equipment producers and automakers) oligopolistic structured, or if they are imperfectly regulated (electric and gas utilities). The incentive arises partly because the infrastructure for

[13] Nordhaus, 2011, pp. 672… 670-671.
[14] Weyent, 2011, pp. xx

producing, distributing, and promoting the industries' current products require large investments that have already been incurred.[15]

He also looks beyond the early phases of research and development on which Nordhaus focuses and notes market imperfections that may retard the adoption and diffusion of technologies on the demand-side.

> Imperfections in the market for energy-converting and energy-consuming equipment may be impeding the rate of diffusion of new technologies that are already economically competitive and welfare improving. This situation can result for several different types of market failure, including poor or asymmetric information available to purchasers, limits on individual's ability to make rational decisions because of time or skill constraints, principal-agent incongruities between building owners and building residents, and lack of financing opportunities.[16]

Roger Noll looks at the contrasting views and concludes that "Superficially, these messages conflict, but both are offered with sufficient caveats that, with minor amendments, these articles provide the right approach to near-term U.S. climate policy. Here I elaborate on the amendments that integrate these articles." [17] His amendments add important considerations that further complicate the terrain of policymaking.

> In principle, one could impose taxes on GHG emissions that correct for information imperfection, coordination failures, and market concentration, but the financial cost to consumers of using price instruments to overcome these problems plausibly could be too high to be politically feasible and higher than the cost of simply subsidizing green energy R&D…
>
> In the absence of targeted government interventions utilities are unlikely to make socially optimal investments in these technologies simply on the basis of an optimal emissions tax and a general R&D subsidy… potential entrants face a problem that, for the foreseeable future, the infrastructure is… a complement as well as a substitute… Thus, efficient diffusion of new green technologies requires involving the incumbents.[18]

Noll worries about the "misapplication of a valid principal," and cautions that "the key question is how much delay is the commercialization of new green technologies likely to occur even if Pigovian taxes and subsidies are imposed. The answer to this question remains unclear." While the available answer is not precise, the evidence suggests that the cost of inertia is quite large, and targeted approaches lower costs and speed the transition.[19]

- The general finding that the social return to R&D is twice as large as the private return appears to hold in the energy technology space.[20]
- Because of the magnitude of the change required, the macroeconomic impacts of policy take on great significance, with analysis of the macroeconomic savings from a

---

15 Weyent, 2011, pp. 677.
16 Weyent, 2011, pp. 675.
17 Noll, 2011, pp. 683.
18 Noll, 2011, pp. 685.
19 Acemoglu, et al, 2012, pp. 132.
20 Qui, 2012, Massetti and Nicita, 2010.

smoother, swifter transition yielding very substantial projected economic savings of at least 50%.[21]

- Estimates of the speed of innovation suggest a one to two decade delay in the introduction of new technologies, if targeted policies to accelerate the diffusion of innovation are not adopted.[22]
- Targeted financial incentives deliver three times as much monetary support for alternatives.[23]

The intense interest in the issues of barriers to change has broken through to the popular press, as demonstrated by a report by Ryan Avent, the Washington-based economic correspondent for the *Economist*. Reporting on "a great session on climate policy"[24] focused on "the environment and directed technical change" and Avent noted that it suggested

> [E]conomics is clearly moving beyond the carbon=tax alone position on climate change, which is a good thing. If the world is to reduce emissions, it needs technologies that are both green and cheap enough to be attractive to economically-stressed countries and people. And a carbon tax alone may not generate the necessary innovation… [T]he carbon externality isn't the only relevant externality in the mix. There is another important dynamic in which technological innovation draws on previous research, and so firms are more likely to continue on established innovation trajectories than to start new ones."[25]

About a year later, David Leonhardt (2013), an economic columnist for the New York Times discussed the practical implications of the growing recognition of the challenge of overcoming inertia and closing the "innovation gap."

> "Over the last several years, the governments of the United States, Europe and China have spent hundreds of billions of dollars on clean-energy research and deployment. And despite some high-profile flops, like ethanol and Solyndra, the investments seem to be succeeding more than they are failing… The successes make it possible at least to fathom a transition to clean energy that does not involve putting a price on carbon — either through a carbon tax or a cap-and-trade program that requires licenses for emissions… To describe the two approaches is to underline their political differences. A cap-and-trade program sets out to make the energy we use more expensive. An investment program aims to make alternative energy less expensive… Most scientists and economists, to be sure, think the best chance for success involves both strategies: if dirty energy remains as cheap as it is today, clean energy will have a much longer road to travel… Still, the clean-energy push has been successful enough to leave many climate advocates believing it is the single best hope… Governments have played a crucial role in financing many of the most important technological inventions of the past century. That's no coincidence: Basic research is often unprofitable. It involves too much failure, and an inventor typically captures only a tiny slice of the profits that flow from a discovery. Although government officials make mistakes when choosing among nascent technologies, one success can outweigh many failures."[26]

---

[21] Grubb Chapuis and Duong, 1995, p. 428,
[22] Dechezlepetre, et al., 2011.
[23] Nordhaus, Shellenberger and Trembath, 2012, calculate that that targeted subsidies yield approximately three times the incentive to invest in low carbon alternatives (compared to coal) as a general carbon tax.
[24] Avent, 2011.
[25] Avent, 2011.
[26] Leohhardt, 2013.

B. Empirical Evidence on the Importance of Market Barriers and Imperfections

Exhibit V-2 presents observations on the factors that can inhibit the transition to energy sources and usage that would reduce greenhouse gas emissions significantly. Exhibit A-IV-2 provides citations. They are presented in the categories of market barriers and imperfections we have used throughout this analysis. For purposes of this literature review, we have applied the same criteria used in the review of the recent efficiency gap literature. We limit the scope to the last ten years and include studies that are empirical or review empirical studies. We see strong parallels between the empirical findings in the analysis of the response to climate change and the efficiency gap analysis.

Exhibit V-2: Market Barriers and Imperfection in Climate Change Analysis

Traditional Economics & Industrial Organization

Externalities
Knowledge Externalities that are not captured by markets, e
Research and Development (20, 22, 23, 48, D), a, b
Importance of learning by searching (27, 31, 38, E), c
Deployment: Importance of learning by doing (27, 10, 31, 38, B), c
Economics of Scale/returns to scale (6, 38, 41, 47, G), d
Localization (24, 38, 45, H))

Market Structure:
Cost Structures: Long investment cycles, increasing returns to scale, network effects (8, 28, 33, 498 I)
Challenge of creating new markets: Undifferentiated product (20, 23, 28, 42, J)
Entry Barriers: Capital Cost, access to network (20, 41, 47 48, K)
Lack of competition hinders innovation (41, 48, L)
Inertia:
Cost of Inertia (1, 14, 28, M)
Importance of inertia/stock of knowledge (9, 24, 37, 45, N)

New Institutional Economics

Endemic
Perverse incentives: in allocation of fuel price volatility (20, 50, O), carbon tax level and permanence (21, 30, 40, 44, P) g
Asymmetric information (21, 48, Q)
Shot-term view, h, i

Transaction Cost
Uncertainty: as a cause of underinvestment (8, 21, 26, 43, 47, R)
Fuel price volatility, carbon tax level and permanence (fuel price volatility, carbon tax level and permanence (20, 33, S)
High risk premia on new technologies (28, T)
Information: Value of information (2, 22, U)
Sunk costs and embedded infrastructure (21, 48, V)
Incomplete markets f

Political Power
Power of incumbents to hinder alternatives (20, 45, ZA)
Monopolistic structures and lack of competition (24, 39 41, 46, 47, ZB)
Importance of institutional support for Alternatives (22, 30, ZC)

Behavioral Economics

Behavior
Sluggish demand response (20, 23, W)
Agency (18, 8, X)
Risk Aversion (6, Y)
Calculation (17, 47, Z)

Effective Policy RESPONSES
Public goods (24, 49, ZC)
Institution Building (22, 30, 49, ZE)
Research and Development (5, 10, 20, 23, 25, 26, 28, 32, 35, 37, 47, ZF)
Capital subsidies Adders, premium prices (6, 41, ZG)
Obligations/Consenting (25, 28, 35, 47, M, (ZH)
Standards (8, 22, ZI)
Feed in Tariffs (28, 41, 45, 47, ZJ)
Merit order (20, 21, ZK)

Evidence on the ineffectiveness of price/ tax as policy
Price Insufficiency (4, 11, 15, 20, 19, 25, 29, 35, 41, 47, 48 A)
Tax: Difficulty of setting and sustaining "optimal" levels (20, 19, 47, B)
Tradable permits do not increase innovation (5, 36, C)

Sources: See Appendix C, Exhibit A-V-2

One primary theme is that the knowledge externality, or innovation gap, is a true externality that is reinforced by important characteristics of the energy market and policy context. Many of the benefits of alternative generation technology resources or the processes by which their costs would be reduced – e.g. learning by doing, network effects – are externalities themselves, which means the private sector will underinvest. [27]

A second major theme is that dislodging a dominant technology requires overcoming a great deal of physical and institutional inertia that has built up over decades. New technologies face significant barriers to entry that are compounded by the existence of entrenched incumbents. Thus, the inertia that supports the dominant incumbent technology is a central factor. A third major theme is market structural barriers to innovation. While the market power problem of dominant incumbents receives a great deal of attention,[28] given the desire to rely on competition and markets, the other market structural problems not associated with market power are equally important. Indeed, since competitive markets would be afflicted by these problems, they are actually a stronger basis to justify public policy to overcome inertia.[29]

Inertia is the result of several sets of market imperfection – market and institutional factors including market structure, endemic, behavioral and transaction costs issues. Some of the market imperfections exacerbate the problem of underinvestment in knowledge creation, but their impact on inertia is paramount. A long period in which fossil fuels were dominant and created a large market makes it the focal point of resources, and investment and will be the focal point of innovative activity. The existing skill sets and economic infrastructure costs reinforce the power of inertia.[30] Moreover, Gross, et al., 2012, point out that the incumbent fossil fuels were the winners, in part, because they were picked in the past and have been favored with policy advantages over a long period of time. The fact that the incumbent technologies have been and continue to be the beneficiaries of subsidies, is more than just a plea for "fairness," however, it reflects the fact that energy markets need these interventions to achieve important social goals, particularly when inertia must be overcome.[31] The ability of dominant incumbents to implement practices and promote policies that magnify the barriers to entry can compound the difficulty of entry if monopolistic

---

27 Gross, et al., 2012, p. 18; Massetti and Nicita, 2010, p. 1The presence of market failures in the R&D sector, as emphasized by Griliches, is confirmed by the evidence, virtually found in all studies, that the social rate of return on R&D expenditure is higher than the corresponding private rate; estimates of the marginal social rate of return on R&D range between 30 and 50 percent and of private return between 7 and 15 percent… When it comes to technologies for carbon emissions reduction, the difference between private and social rate of return to R&D investment arises from a double externality; the presence of both environmental and knowledge externalities. First, without a price on carbon that equates the global and the private cost of emitting GHGs, all low emissions technologies are relatively disadvantaged and the level of investment is therefore sub-optimal. Second, the private return to investment in R&D is lower than the social return of investment due to the incomplete appropriability of knowledge creation, thus pushing further away investment for the socially optimal level.

28 Gross, et al, 2012; Nicolli and Vona, 2012,

29 Jamasb and Kohler, 2007, p. 9, Information technology and pharmaceuticals, for example, are both characterized by high degrees of innovation, with rapid technological change financed by private investment amounting typically to 10-20% of sector turnover. This is in dramatic contrast with power generation, where a small number of fundamentals technologies have dominated for almost a century and private sector RD&D has fallen sharply with privatization of energy industries to the point where it is uner 0.4% of turnover.

30 Gross, et a;l, 2012, p.18.

31 Gross, et al., p.18, The phenomenon of "learning by doing", whereby costs for technologies reduces as experience is gained from deployment of the technology creates lock-in. It also creates better, cheaper technologies. The incumbent fossil and nuclear forms of generation have had many decades of technical refinement through experience which have driven their costs down to low levels relatife to new, renewable technologies. In part, this was financed by considerable public subsidy… The very same effects that created locik-in to high carbon systems offer the potential to decrease the coss and improve the commercial/consumer attractiveness of new forms of low carbon energy.

bottlenecks are allowed to hamper access to the network, like incumbent control of access to the grid or dispatch. [32]

Since the alternative technologies are at a disadvantage in terms of development and the ability to attract resources, just raising the cost of the dominant fuels does not overcome the inertia and actually allows the gap between the incumbent and alternative technologies to persist or even grow.

The inertia can be compounded by several other factors including monopolistic distortions in the incumbent market, a lack of substitutability between the alternatives and limited spillovers from innovation in the incumbent technology. With an exhaustible resource, the problem can be particularly acute, as a tendency to underestimate the long term consequences of continuing dependence on it are not fully reflected in current decision making. Long lead times, increasing returns to scale and network effects make entry difficult (if not impossible).[33] The undifferentiated nature of the product makes it hard for new entrants to secure a foothold (niche) from which to build scale and learn-by doing.[34] Price volatility and other sources of uncertainty reduce the incentive to invest.[35] One of the most important additional sources of uncertainty beyond price is the uncertainty about the commitment to and sustainability of high carbon taxes needed to make alternatives attractive. [36] One of the causes of this uncertainty about policy commitment is the uneven social and geographic impact of high carbon taxes and the concern about high impact industries.[37]

The allocation of fuel price risk creates a disincentive to innovation.[38] The fact that the problem occurs in both regulated and deregulated markets suggests it is an endemic problem. Merit order dispatch and single price auctions set the market clearing price at the highest variable cost needed to clear the market. In regulated systems, fuel price risk for the marginal generator is shifted to ratepayers with adjustment clauses. In market systems, the risk is transferred to consumers and magnified, as noted early because all generators are paid the market clearing price. The marginal generator is shielded from risk. Combining the price setting function with the fact that marginal generators tend to have low capital costs, tends to insulate these generators from the risk of price volatility, which is shifted to consumers and alternative suppliers. Alternative generators, who have

---

[32] Walz, 2007, Walz Scleich and Ragwitz, 2011.

[33] Kahlkuhl, Edenhoffer and Lessmann, 2012.

[34] Kalkuhl, Edenhofer and Lessmann, 2012, p. 10, The energy sector is highly vulnerable to lock-in because electricity is an almost perfect substitute for consumers. In contast, many innovations in the manufacturing or entertainment electronics sector provide a new product different from existing ones(e/g/ flat screens vs. CRT monitor). The low substitutability implies a high niched demand and, thus, provokes ongoing learning-by-doing although considerable spillovers exist and market prices are distorted.

[35] Cian and Massimo, 2011, p. 123, Uncertainty and irreversibility are two features of climate change that contribute to shape the decision making process. Technology cost uncertainty can depress the incentive to ivest. The risk of underinvestment is even more severe considering that energy infrastructure has a slow turnover. Capital irreversibility and uncertainty heighten the risk of locking into existing fossil-fuel-based technologies. Additional investment are sunk costs that increase the opportunity cost of acting now… The result is reinforced when uncertain costs have a large variance, showing that investments decrease with risk.

[36] Gross, et al, 2012, p. 16.

[37] Walsz, 16.

[60] Gross, Blyth and Heponstall, 2012, p. 802.The first conclusion is that policymaking in the energy area needs new tools of analysis that can deal with the market risks associated with policy design… In particular, policymakers need to be mindful of the role of revenue risk as well as cost risk in the business case for investment.

high capital costs and low operating costs and do not set the market clearing price, also bear the burden of fuel price risk.[39]

Consumers respond sluggishly to price increases, so the shifting of the risk of price volatility onto the consumers does not have the hoped for effect in stimulating demand for alternative resources.[40] Energy consuming durable have long lives and consumers frequently do not make the purchase decision. The agents who make the purchase decisions and consumers are first cost sensitive and have difficulty projecting energy prices and quantities to make lifecycle cost calculations. [41] The demand–side does not receive the attention commensurate with its importance as a source of market failure or its potential impact on the transition to a decarbonized sector.[42]

The set of factors that underlies the inertia that would retard the response to climate change are market barriers and imperfections that are similar to the set of factors that underlie the "efficiency gap." The debate among economists grappling with the analysis of climate change replicates and parallels the efficiency gap debate. The conceptual and empirical analysis of climate change adds a great deal of evidence to reinforce the conclusions about the barriers and imperfections that affect energy markets.

---

[39] Gross, et al,, 2012, pp. 13-14.

[40] Walz, 2011, Elder 2010; Jamasb and Kohler,2007,p. 8-9.

[41] Greene, 2010.

[42] Eilson, et al., 2012,

APPENDIX
ANNOTATED VERSIONS OF EXHIBITS

EXHIBIT A-II-2: MARKET BARRIERS TO ENERGY EFFICIENCY

Barriers[1]	Market Failures	Transaction Cost[2]	Behavioral factors[16]
Misplaced incentives	Externalities	Sunk costs[3]	Custom[17]
Agency[4]	Mis-pricing[20]	Lifetime[5]	Values[18] & Commitment[19]
Capital Illiquidity[8]	Public Goods[22]	Risk[6] & Uncertainty[7]	Social group & status[21]
Bundling	Basic research[23]	Asymmetric Info.[9]	Psychological Prospect[24]
Multi-attribute	Information	Imperfect Info.[10]	Ability to process info[27]
Gold Plating[11]	(Learning by Doing)[25]	Availability	Bounded rationality[26]
Inseparability[13]	Imperfect Competition/	Cost[12]	
Regulation	Market Power[28]	Accuracy	
Price Distortion[14]			
Chain of Barriers			
Disaggregated Mkt.[15]			

William H. Golove and Joseph H. Eto, *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency;*

1) Six market barriers were initially identified: 1) misplaced incentives, 2) lack of access to financing, 3) flaws in market structure, 4) mis-pricing imposed by regulation, 5) decision influenced by custom, and 6) lack of information or misinformation. Subsequently a seventh barrier, referred to as "gold plating," was added to the taxonomy (p.9).
2) Neo-classical economics generally relies on the assumption of frictionless transactions in which no costs are associated with the transaction itself. In other words, the costs of such activities as collecting and analyzing information; negotiating with potential suppliers, partners, and customers; and assuming risk are assumed to be nonexistent or insignificant. This assumption has been increasingly challenged in recent years. The insights developed through these challenges represent an important new way to evaluate aspects of various market failures (especially those associated with imperfect information). Transaction cost economics examines the implications of evidence suggesting that transaction costs are not insignificant but, in fact, constitute a primary explanation for the particular form taken by many economic institutions and contractual relations (p. 22).
3) Transaction cost economics also offers support for claims that the illiquidity of certain investments leads to higher interest rates being required by investors in those investments (p. 23).
4) Misplaced, or split, incentives are transactions or exchanges where the economic benefits of energy conservation do not accrue to the person who is trying to conserve (p. 9).
5) Thus, as the rated lifetime of equipment increases, the uncertainty and the value of future benefits will be discounted significantly. The irreversibility of most energy efficiency investments is said to increase the cost of such investments because secondary markets do not exist or are not well-developed for most types of efficient equipment. This argument contends that illiquidity results in an option value to delaying investment in energy efficiency, which multiplies the necessary return from such investments (p. 16)
6) If a consumer wishes to purchase an energy-efficient piece of equipment, its efficiency should reduce the risk to the lender (by improving the borrower's net cash flow, one component of credit-worthiness5) and should, but does not, reduce the interest rate, according to the proponents of the theory of market barriers. (p.10). Potential investors, it is argued, will increase their discount rates to account for this uncertainty or risk because they are unable to diversify it away. The capital asset pricing model (CAPM) is invoked to make this point (p. 16).
7) Perfect information includes knowledge of the future, including, for example, future energy prices. Because the future is unknowable, uncertainty and risk are imposed on many transactions. The extent to which these unresolvable uncertainties affect the value of energy efficiency is one of the central questions in the market barriers debate. Of course, inability to predict the future is not unique to energy service markets. What is unique is the inability to diversify the risks associated with future uncertainty to the same extent that is available in other markets (p. 20).
8) In practice, we observe that some potential borrowers, for example low-income individuals and small business owners, are frequently unable to borrow at any price as the result of their economic status or "credit-worthiness." This lack of access to capital inhibits investments in energy efficiency by these classes of consumers (p. 10).
9) Finally, Williamson (1985) argues that the key issue surrounding information is not its public goods character, but rather its asymmetric distribution combined with the tendency of those who have it to use it opportunistically (p. 23).
10) [K]nowledge of current and future prices, technological options and developments, and all other factors that might influence the economics of a particular investment. Economists acknowledge that these conditions are frequently not and in some cases can never be met. A series of information market failures have been identified as inhibiting investments in energy efficiency: (1) the lack of information, (2) the cost of information, (3) the accuracy of information, and (4) the ability to use or act upon information (p. 20).
11) The notion of "gold plating" emerged from research suggesting that energy efficiency is frequently coupled with other costly features and is not available separately (p.11).
12) Even when information is potentially available, it frequently is expensive to acquire, requiring time, money or both (p. 20).
13) Inseparability of features refers specifically to cases where availability is inhibited by technological limitations. There may be direct tradeoffs between energy efficiency and other desirable features of a product. In contrast to gold plating where the consumer must purchase more features than are desired, the inseparability of features demands purchases of lower levels of features than desired. (p.12)
14) The regulation barrier referred to mis-pricing energy forms (such as electricity and natural gas) whose price was set administratively by regulatory bodies (p. 11).
15) On the cost-side of the equation, the critics contend that, among other things, information and search costs have typically been ignored or underestimated in engineering/economic analyses. Time and/or money may be spent: acquiring new information (search costs), installing new equipment, training operators and maintenance technicians, or supporting increased maintenance that may be associated with the energy efficient

equipment (p.16). [T]he class, itself, consists of a distribution of consumers: some could economically purchase additional efficiency, while others will find the new level of efficiency is not cost effective (p. 13).

16) Discounted cash-flow, cost-benefit, and social welfare analyses use price as the complete measure of value although in very different ways; behavioral scientists, on the other hand, have argued that a number of "noneconomic" variables contribute significantly to consumer decision making (p. 17).
17) [C]ustom and information have evolved significantly during the market barrier debate (p. 11).
18) In the language of (economic) utility theory, the profitability of energy efficiency investments is but one attribute consumers evaluate in making the investment. The value placed on these other attributes may, in some cases, outweigh the importance of the economic return on investment (p. 19).
19) [P]sychological considerations such as commitment and motivation play a key role in consumer decisions about energy efficiency investments (p. 17).
20) Externalities refer to costs or benefits associated with a particular economic activity or transaction that do not accrue to the participants in the activity (p. 18).
21) Other factors, such as membership in social groups, status considerations, and expressions of personal values play key roles in consumer decision-making (p.17). In order for a market to function effectively, all parties to an exchange or transaction must have equal bargaining power. In the event of unequal bargaining positions, we would expect that self-interest would lead to the exploitation of bargaining advantages (p. 19).
22) Public goods are said to represent a market failure. It has been generally acknowledged by economists and efficiency advocates that public good market failures affect the energy services market. (p. 19) [T]he creation of information is limited because information has public good qualities. That is, there may be limits to the creator's ability to capture the full benefits of the sale or transfer of information, in part because of the low cost of subsequent reproduction and distribution of the information, thus reducing the incentive to create information that might otherwise have significant value (p. 20).
23) Investment in basic research in believed to be subject to this shortcoming; because the information created as a result of such research may not be protected by patent or other property right, the producer of the information may be unable to capture the value of his/her creation (p. 19).
24) Important theoretical refinements to this concept, known as prospect theory, have been developed by Tversky and Kahneman (1981, 1986). This theory contends that individuals do not make decisions by maximizing prospective utility, but rather in terms of difference from an initial reference point. In addition, it is argued that individuals value equal gains and losses from this reference point differently, weighing losses more heavily than gains (p.21).
25) The information created by the adoption of a new technology by a given firm also has the characteristics of a public good. To the extent that this information is known by competitors, the risk associated with the subsequent adoption of this same technology may be reduced, yet the value inherent in this reduced risk cannot be captured by its creator (p. 19).
26) This work is consistent with the notion of bounded rationality in economic theory. In contrast to the standard economic assumption that all decision makers are perfectly informed and have the absolute intention and ability to make decisions that maximize their own welfare, bounded rationality emphasizes limitations to rational decision making that are imposed by constraints on a decision maker's attention, resources, and ability to process information. It assumes that economic actors intend to be rational, but are only able to exercise their rationality to a limited extent (p.21).
27) Finally, individuals and firms are limited in their ability to use — store, retrieve, and analyze — information. Given the quantity and complexity of information pertinent to energy efficiency investment decisions, this condition has received much consideration in the market barriers debate (p. 20).
28) This barrier suggests that certain powerful firms may be able to inhibit the introduction by competitors of energy-efficient, cost-effective products (p. 10).

EXHIBIT A-II-3: MARKET AND BEHAVIORAL FAILURES RELEVANT TO ENERGY EFFICIENCY

Societal Failures

- Energy Market Failures
  - Environmental Externalities[1]
  - Energy Security
- Innovation market failures
  - Research and development spillovers[2]
  - Learning-by-doing spillovers[3]
  - Learning-by-using[4]

Structural Failures

- Capital Market Failures
  - Liquidity constraints[5]
- Information problems[6]
  - Lack of information[7]
  - Asymmetric info. >
    - Adverse selection[8]
  - Principal-agent problems[9]
  - Average-cost electricity pricing[10]

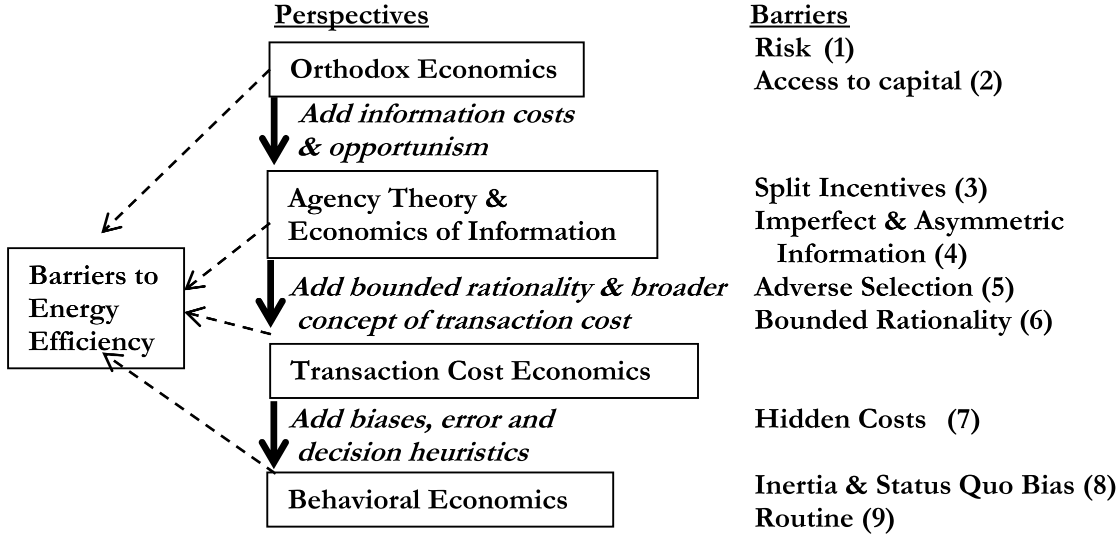
Potential Behavioral Failures[11]

- Prospect theory[12]
- Bounded rationality[13]
- Heuristic decision making[14]
- Information[15]

1) Externalities: the common theme in energy market failures is that energy prices do not reflect the true marginal social cost of energy consumption, either through environmental externalities, average cost pricing, or national security (9).
2) R&D spillovers may lead to underinvestment in energy-efficient technology innovation due to the public good nature of knowledge, whereby individual firms are unable to fully capture the benefits from their innovation efforts, which instead accrue partly to other firms and consumers (11).
3) Learning-by-doing (LBD) refers to the empirical observation that as cumulative production of new technologies increases, the cost of production tends to decline as the firm learns from experience how to reduce its costs (Arrow 1962). LBD may be associated with a market failure if the learning creates knowledge that spills over to other firms in the industry, lowering the costs for others without compensation.
4) Positive externalities associated with learning-by-using can exist where the adopter of a new energy-efficient product creates knowledge about the product through its use, and others freely benefit from the information generated about the existence, characteristics, and performance of the product (12).
5) Capital: Some purchasers of equipment may choose the less energy-efficient product due to lack of access to credit, resulting in underinvestment in energy efficiency and reflected in an implicit discount rate that is above typical market levels (13).
6) Information: Specific information problems cited include consumers' lack of information about the availability of and savings from energy-efficient products, asymmetric information, principal-agent or split-incentive problems, and externalities associated with learning-by-using (11).
7) Lack of information and asymmetric information are often given as reasons why consumers systematically underinvest in energy efficiency. The idea is that consumers often lack sufficient information about the difference in future operating costs between more-efficient and less-efficient goods necessary to make proper investment decisions (11).
8) Asymmetric information, where one party involved in a transaction has more information than another, may lead to adverse selection (11).
9) Agency: The principal-agent or split-incentive problem describes a situation where one party (the agent), such as a builder or landlord, decides the level of energy efficiency in a building, while a second party (the principal), such as the purchaser or tenant, pays the energy bills. When the principal has incomplete information about the energy efficiency of the building, the first party may not be able to recoup the costs of energy efficiency investments in the purchase price or rent charged for the building. The agent will then underinvest in energy efficiency relative to the social optimum, creating a market failure (12).
10) Prices faced by consumers in electricity markets also may not reflect marginal social costs due to the common use of average-cost pricing under utility regulation. Average-cost pricing could lead to under- or overuse of electricity relative to the economic optimum (10).
11) Systematic biases in consumer decision making that lead to underinvestment in energy efficiency relative to the cost-minimizing level are also often included among market barriers. (8); The behavioral economics literature has drawn attention to several systematic biases in consumer decision making that may be relevant to decisions regarding investment in energy efficiency. Similar insights can be gained from the literature on energy decision-making in psychology and sociology. The evidence that consumer decisions are not always perfectly rational is quite strong, beginning with Tversky and Kahneman's research indicating that both sophisticated and naïve respondents will consistently violate axioms of rational choice in certain situations (15).
12) The welfare change from gains and losses is evaluated with respect to a reference point, usually the status quo. In addition, consumers are risk averse with respect to gains and risk seeking with respect to losses, so that the welfare change is much greater from a loss than from an expected gain of the same magnitude (Kahneman and Tversky 1979). This can lead to loss aversion, anchoring, status quo bias, and other anomalous behavior (16).
13) Bounded rationality suggests that consumers are rational, but face cognitive constraints in processing information that lead to deviation from rationality in certain circumstances (16); Assessing the future savings requires forming expectations of future energy prices, changes in other operating costs related to the energy use (e.g., pollution charges), intensity of use of the product, and equipment lifetime. Comparing these expected future cash flows to the initial cost requires discounting the future cash flows to present values (3).
14) Heuristic decision-making is related closely to bounded rationality and encompasses a variety of decision strategies that differ in some critical way from conventional utility maximization in order to reduce the cognitive burden of decision-making. Tversky (1972) develops the theory of elimination-by-aspects," wherein consumers use a sequential decision making process where they first narrow their full choice set to a smaller set by eliminating products that do not have some desired feature or aspect (e.g., cost above a certain level), and then they optimize among the smaller choice set, possibly after eliminating further products. (16) For example, for decisions regarding energy-efficient investments consumers tend to use a simple payback measure where the total investment cost is divided by the future savings calculated by using the energy price today, rather than the price at the time of the savings— effectively ignoring future increases in real fuel prices (p. 17). The salience effect may influence energy efficiency decisions, potentially contributing to an overemphasis on the initial cost of an energy-efficient purchase, leading to an underinvestment in energy efficiency. This may be related to evidence suggesting that decision makers are more sensitive to up-front investment costs than energy operating costs, although this evidence may also be the result of inappropriate measures of expectations of future energy use and prices (17).
15) Alternatively, information problems may occur when there are behavioral failures, so that consumers are not appropriately taking future reductions in energy costs into account in making present investments in energy efficiency (12).

Source: Kenneth Gillingham, Richard G. Newell, and Karen Palmer, *Energy Efficiency Economics and Policy* (Resources for the Future, April 2009)

EXHIBIT A-II-4: BARRIERS TO INDUSTRIAL ENERGY EFFICIENCY



Steve Sorrell, Alexandra Mallett & Sheridan Nye. *Barriers to industrial energy efficiency, A literature review,* United Nations Industrial Development Organization, Vienna, 2011, Figure 3.1 & Section 3.

(1) Risk: The short paybacks required for energy efficiency investments may represent a rational response to risk. This could be because energy efficiency investments represent a higher technical or financial risk than other types of investment, or that business and market uncertainty encourages short time horizons.
(2) Access to capital: If an organization has insufficient capital through internal funds, and has difficulty raising additional funds through borrowing or share issues, energy efficient investments may be prevented from going ahead. Investment could also be inhibited by internal capital budgeting procedures, investment appraisal rules and the short-term incentives of energy management staff.
(3) Split incentives: Energy efficiency opportunities are likely to be foregone if actors cannot appropriate the benefits of the investment. Wide applicability… Landlord-tenant problems may arise in the industrial, public and commercial sectors through the leasing of buildings and office space. The purchaser may have a strong incentive to minimise capital costs, but may not be accountable for running costs….maintenance staff may have a strong incentive to minimize capital costs and/or to get failed equipment working again as soon as possible, but may have no incentive to minimise running costs. If individual departments within an organization are not accountable for their energy use they will have no incentive to improve energy efficiency.
(4) Imperfect information: Lack of information on energy efficiency opportunities may lead to cost-effective opportunities being missed. In some cases, imperfect information may lead to inefficient products driving efficient products out of the market. Information on: the level and pattern of current energy consumption and comparison with relevant benchmarks; specific opportunities, such as the retrofit of thermal insulation; and the energy consumption of new and refurbished buildings, process plant and purchased equipment, allowing choice between efficient and inefficient options.
Asymmetric information exists where the supplier of a good or service holds relevant information, but is unable or unwilling to transfer this information to prospective buyers.
(5) Asymmetric information may lead to the adverse selection of energy inefficient goods.
(6) Bounded rationality: Owing to constraints on time, attention, and the ability to process information, individuals do not make decisions in the manner assumed in economic models. As a consequence, they may neglect opportunities for improving energy efficiency, even when given good information and appropriate incentive consumers do not attempt to maximise their utility or producers their profits.
(7) Hidden costs Engineering-economic analyses may fail to account for either the reduction in utility associated with energy efficient technologies, or the additional costs associated with them. As a consequence, the studies may overestimate energy efficiency potential. Examples of hidden costs include overhead costs for management, disruptions to production, staff replacement and training, and the costs associated with gathering, analysing and applying information.
General overhead costs of energy management: employing specialist people (e.g., energy manager); energy information systems (including: gathering of energy consumption data; maintaining sub metering systems; analysing data and correcting for influencing factors; identifying faults; etc.); energy auditing;
Costs involved in individual technology decisions: i) identifying opportunities; ii) detailed investigation and design; iii) formal investment appraisal; formal procedures for seeking approval of capital expenditures; specification and tendering for capital works to manufacturers and contractors additional staff costs for maintenance; replacement, early retirement, or retraining of staff; disruptions and inconvenience;
Loss of utility associated with energy efficient: problems with safety, noise, working conditions, service quality etc. (e.g., lighting levels); extra maintenance, lower reliability,
(8) Inertia and the status quo bias: Routines can be surprisingly persistent and entrenched. … This type of problem has been labeled *inertia* within the energy efficiency literature and identified as a relevant explanatory variable for the efficiency gap
(9) Routines as a response to bounded rationality the use of formal capital budgeting tools within investment decision-making. Other types of rules and routines which may impact on energy efficiency include: operating procedures (such as leaving equipment running or on standby); safety and maintenance procedures; relationships with particular suppliers; design criteria; specification and procurement procedures; equipment replacement routines and so on.

Exhibit A-II-7: Recent Empirical Evidence on Market Failures, Barriers and Imperfections

<u>Traditional Economics & Industrial Organization</u>

Externalities

Public goods[1] & Bads[2]
Basic research
Network effects
Information as a public good
Learning-by-doing & Using[9]

Industry Structure

Imperfect Competition
- Concentration[13]
- Barriers to entry
- Scale[18]
- Switching costs[20]

Technology[23]
- R&D
- Investment[25]

Marketing
- Bundling: Multi-attribute[26]
- Substitutes[27]

Cost-Price
- Limit impact of price[29]
  - Fragmented Mkt.[30]
  - Limited payback[31]

Regulation

Price[34]
- Infrequent
- Aggregate, Avg.-cost[35]

Lack of commitment[36]

<u>New Institutional economics</u>

Endemic Imperfections

Asymmetric Info[3].
Agency[5]
Adverse selection[6]
Perverse incentives
Lack of capital[10]

<u>Transaction Cost</u>

Search and Information
- Imperfect info[14]
  - Availability[16]
  - Accuracy
  - Search cost[21]

Bargaining
- Risk & Uncertainty[24]
- Liability

Enforcement
Sunk costs
Hidden cost[28]

<u>Political Power</u>

Power of incumbents to hinder alternatives
Monopolistic structures and lack of competition
Importance of institutional support for Alternatives[32]
Inertia[33]

<u>Behavioral Economics</u>

Motivation & Values

Non-economic[4]

Influence & Commitment

Custom[7]
Social group & status[8]

Perception

Bounded Vision/Attention[11]
Prospect[12]

Calculation.

Bounded rationality[15]
Limited ability to process info[17]
Heuristic decision making[19]
Discounting difficulty[22]

Citations

1. Macroeconomic: Edelstein and Killian, 2009, p. 13, [T]he cumulative effects on real consumption associated with energy price shocks are quantitatively important. We showed that the responses of real consumption aggregates are too large to reflect the effects of unanticipated change in discretionary income alone. Our analysis suggests that the excess response can be attributed to shifts in precautionary savings and to changes in the operating costs of energy using durables.
2. Committee On Health, Environmental, And Other External Costs And Benefits Of Energy Production And Consumption, 2011, p. I, D]espite energy's many benefits, most of which are reflected in energy market prices, the production, distribution, and use of energy also cause negative effects. Beneficial or negative effects that are not reflected in energy market prices are termed "external effects" by economists. In the absence of government intervention, external effects associated with energy production and use are generally not taken into account in decision making. When prices do not adequately reflect them, the monetary value assigned to benefits or adverse effects (referred to as damages) are "hidden" in the sense that government and other decision makers, such as electric utility managers, may not recognize the full costs of their actions. When market failures like this occur, there may be a case for government interventions in the form of regulations, taxes, fees, tradable permits, or other instruments that will motivate such recognition.
3. UNIDO, 2011, p. 19, Asymmetric information exists where the supplier of a good or service holds relevant information, but is unable or unwilling to transfer this information to prospective buyers. The extent to which asymmetric information leads to market failure will depend upon the nature of the good or service…. In contrast to

energy commodities, energy efficiency may only be considered a search good when the energy consumption of a product is clearly and unambiguously labelled and when the performance in use is insensitive to installation, operation and maintenance conditions. But for many goods, the information on energy consumption may be missing, ambiguous or hidden, and the search costs will be relatively high. In the absence of standardised performance measures or rating schemes, it may be difficult to compare the performance of competing products. Taken together, these features tend to make energy efficiency closer to a *credence good* and hence more subject to market failure. Thus, to the extent that energy supply and energy efficiency represent different means of delivering the same level of energy service, the latter is likely to be disadvantaged relative to the former. The result is likely to be overconsumption of energy and under-consumption of energy efficiency.

4. Alcott, 2011, p. 1, Results show that beliefs are both highly noisy, consistent with imperfect information and bounded computational capacity, and systematically biased in manner symptomatic of "MPG illusion;" Alcott and Wozny, 2010.
5. Davis, xxx, p. 1; Extensive analysis of U.S. and global markets support the conclusion that this is an important impediment to greater energy efficiency of consumer durables. "The results show that, controlling for household income and other household characteristics, renters are significantly less likely to have energy efficient refrigerators, clothes washers and dishwashers."
6. UNIDO, 2011, p. 19, In some circumstances, asymmetric information in energy service markets may lead to the adverse selection of energy inefficient goods. Take housing as an example. In a perfect market, the resale value of a house would reflect the discounted value of energy efficiency investments. But asymmetric information at the point of sale tends to prevent this. Buyers have difficulty in recognising the potential energy savings and rarely account for this when making a price offer. Estate agents have greater resources than buyers, but similarly neglect energy efficiency when valuing a house. Since the operating costs of a house affect the ability of a borrower to repay the mortgage, they should be reflected in mortgage qualifications. Again, they are not. In all cases, one party (e.g., the builder or the seller) may have the relevant information, but transaction costs impede the transfer of that information to the potential purchaser. The result may be to discourage house builders from constructing energy efficient houses, or to discourage homeowners from making energy efficiency improvements since they will not be able to capture the additional costs in the sale price.
7. Ozaki and Sevastyanove, 2009.
8. Claudy and O'Dricoll, 2008, p. 11, "A growing body of literature around energy conservation contends that investment into energy efficiency measure is often motivated by "conviction" rather than "economics." Behavioral factors, including attitudes and values, explain a greater amount of variation in proenvironmental behaviour and provide valuable insights for policy makers and analysts."
9. Deroches, 2011, p. 1, Costs and prices generally fall in relations to cumulative production, a phenomenon known as experience and modeled as a fairly robust empirical experience curve… These experience curves… incorporated into recent energy conservation standards… impact on the national modeling can be significant, often increasing the net present value of potential standard levels… These results imply that past energy conservation standards analyses may have undervalued the economic benefits of potential standard levels.
10. UNIDO, 2011, p. iii, If an organization has insufficient capital through internal funds, and has difficulty raising additional funds through borrowing or share issues, energy efficient investments may be prevented from going ahead. Investment could also be inhibited by internal capital budgeting procedures, investment appraisal rules and the short-term incentives of energy management staff.
11. Alcott, 2009, p. 1. "I provide evidence to suggest that at least some of this effect is because consumers' attention is malleable and non-durable." UNIDO, pp. viii, Owing to constraints on time, attention, and the ability to process information, individuals do not make decisions in the manner assumed in economic models. As a consequence, they may neglect opportunities for improving energy efficiency, even when given good information and appropriate incentive consumers do not attempt to maximise their utility or producers their profits.
12. Sardiano, 2007, p. 1417, Decision making process to invest in energy efficiency improvement, like other investments, is a function of the behavior of individual or of various actors within the industrial firm. In this context, managerial attitudes toward energy conservation are also important factors… [E]nergy efficiency measures are often not overlooked by management because it is not a core business activity and it is thus not worth much attention.
13. Blumstein, 2013, p. 5, [T]he existence of market power dampens the responsiveness of suppliers of goods or services to consumer demand, as actors in a monopolistic or oligopolistic setting can more or less set prices and quality attributes.
14. Atari, et. al., 2010, p. 1. For a sample of 15 activities, participants underestimated energy use and savings by a factor of 2.8 on average, with small overestimates for lower-energy activities and large, underestimates for high-energy activities." Jessoe and Rapson, 2013, p. 34, "These results confirm the practical importance of one of economics' most ubiquitous assumptions – that decision makers have perfect information. Indeed, the absence of perfect information is likely to cause substantial efficiency loses both in this setting and others in which quantity is also

infrequently or partially observed by decision makers." Consumers Union, 2012, p. 8, "this suggests that many consumers are misinformed about the program requirements.

15. Green, German and Delucchi, 2009, p. 203; "The uncertainty/loss aversion model of consumers' fuel economy decision making implies that consumers will undervalue expected future fuel savings to roughly the same degree as manufacturers' perception that consumers demand short payback periods."
16. UNIDO, 2011, p. iii, Lack of information on energy efficiency opportunities may lead to cost-effective opportunities being missed. In some cases, imperfect information may lead to inefficient products driving efficient products out of the market. Information on: the level and pattern of current energy consumption and comparison with relevant benchmarks; specific opportunities, such as the retrofit of thermal insulation; and the energy consumption of new and refurbished buildings, process plant and purchased equipment, allowing choice between efficient and inefficient options.
17. Atari, et. al., 2010, p. 1. For a sample of 15 activities, participants underestimated energy use and savings by a factor of 2.8 on average, with small overestimates for lower-energy activities and large, underestimates for high-energy activities."
18. Montvalo, 2007, p. S10, Due to the size of investment and longevity or production processes it is very likely that the diffusion of new processes will occur in an incremental way.
19. Ito, 2010, p. 1, Evidence from laboratory experiments suggests that consumers facing such price schedules may respond to average price as a heuristic. I empirically test this prediction using field data.
20. Sardianou, 2007, p. 1419, Our empirical results also confirm that organizational constraints and human related factors can be thought of as barriers in incorporating the energy saving technology in incorporating the energy saving technology in the existing production process.
21. Sardianou, 2007, p. 1419, Having limited information with regard to energy conservation opportunities and their profitability is considered an obstacle…. Other possible barriers include lack of documentation of energy data.
22. Kurani and Turrentine, 2004, p. 1, One effect of limited knowledge is that when consumers buy a vehicle, they do not have the basic building blocks of knowledge to make an economically rational decision. When offered a choice to pay more for better fuel economy, most households were unable to estimate potential savings, particularly over periods of time greater than one month. In the absence of such calculations, many households were overly optimistic about potential fuel savings, wanting and thinking they could recover an investment of several thousand dollars in a couple of years.
23. Montvalo, 2007, p. A10, Finally, firms face the challenge of technological risk. The gains promised by new technologies have yet to materialize, a situation that contrasts strongly with the perceived reliability of the current, familiar operating process. In the literature on technology management it has been established that adoption or development of new production processes implies the capacity to integrate new knowledge and large organizational change.
24. UNIDO, 2011, p. iii, The short paybacks required for energy efficiency investments may represent a rational response to risk. This could be because energy efficiency investments represent a higher technical or financial risk than other types of investment, or that business and market uncertainty encourages short time horizons.
25. Montvalo, 2007, p. s10, Closely related to these technological opportunities are the firm and sector level capabilities to actually adopt new technologies. It has been reported that insufficient availability of expertise in clear production (eco-design) the current training and clean technology capacity building at the sector level and the insufficient understanding and experience in cleaner production project development and implementation, play a role in the adoption of new cleaner production processes. These factors can be expected to become even more critical at the level of small- and medium sized enterprises..
26. Gabaix and Laibson, 2005, p. 1; "We show that information shrouding flourishes even in highly competitive markets, even in markets with costless advertising, and even when the shrouding generation allocational inefficiencies." Hosain and Morgan, Brown, Hossain and Morgan
27. Sallee, 2012, "The possibility of rational inattention has two key implications. First, if consumers rationally ignore energy efficiency, this could explain the energy paradox. In equilibrium, firms will underprovide energy efficiency if consumers ignore it. If true, this would qualitatively change the interpretation of empirical work on the energy paradox. Most empirical work tests for the rationality of consumer choice across goods that are actually sold in the market. If rational inattention leads to an inefficiency set of *product offerings* (emphasis added), consumer might choose rationally among goods in equilibrium but a paradox still exists. Second, if consumers are rationally inattentive to energy efficiency, this could provide direct justification for regulatory standards and "no tech policies, such as the Energy Star Label System." Green, German and Delucchi, 2009, p. 203; This suggests that increasing fuel prices may not be the most effective policy for increasing the application of technologies to increase passenger and light truck fuel economy. This view is supported by the similar levels of technology applied to U.S. and European passenger cars in the 1990s, despite fuel prices roughly three times higher in Europe. It is also circumstantially supported by

the adoption by governments around the world of regulatory standard for light-duty vehicle fuel economy and carbon dioxide emissions.

28. UNIDO, 2011, p. iii, Hidden costs Engineering-economic analyses may fail to account for either the reduction in utility associated with energy efficient technologies, or the additional costs associated with them. As a consequence, the studies may overestimate energy efficiency potential. Examples of hidden costs include overhead costs for management, disruptions to production, staff replacement and training, and the costs associated with gathering, analysing and applying information. General overhead costs of energy management: employing specialist people (e.g., energy manager); energy information systems (including: gathering of energy consumption data; maintaining sub metering systems; analysing data and correcting for influencing factors; identifying faults; etc.); energy auditing; Costs involved in individual technology decisions: i) identifying opportunities; ii) detailed investigation and design; iii) formal investment appraisal; formal procedures for seeking approval of capital expenditures; specification and tendering for capital works to manufacturers and contractors additional staff costs for maintenance; replacement, early retirement, or retraining of staff; disruptions and inconvenience; Loss of utility associated with energy efficient: problems with safety, noise, working conditions, service quality etc. (e.g., lighting levels); extra maintenance, lower reliability.
29. Li, Timmins and von Haefen, 2009, "we are able to decompose the effects of gasoline prices on the evolution of the vehicle fleet into changes arising from the inflow of new vehicles and the outflow of used vehicles. We find that gasoline prices have statistically significant effects on both channels, but their combined effects results in only modest impacts on fleet fuel economy. The short-run and long-run elasticities of fleet fuel economy with respect to gasoline prices are estimated at 0.o22 and 0.204in 2005. "
30. Committee to Assess Fuel Economy, 2010, p. 2, The [Medium and Heavy Duty] truck world is more complicated. There are literally thousands of different configurations of vehicle including bucket trucks, pickup trucks, garbage trucks, delivery vehicles, and long-haul trailers. Their duty cycles vary greatly… the party responsible for the final truck configuration is often not well defined.; Lutzenheiser, et al., (2001, cited in Blumstein, 2013), p. viii, The commercial building "industry" is in fact a series of linked industries arrayed along a "value chain" or "value stream" where each loosely coupled link contributes value to a material building in process. Each link, while aware of the other links in the process, is a somewhat separate social world with its own logic, language, actors, interests, and regulatory demands. For the most part "upstream" actors constrain the choices and actions of "downstream" actors.
31. Sardianou, 2007, p. 1419, The lack of access to capital (76%) and the slow rate of return (74%) of energy savings investments are categorized as barriers.
32. UNIDO, 2011, p. iii, Routines as a response to bounded rationality the use of formal capital budgeting tools within investment decision-making. Other types of rules and routines which may impact on energy efficiency include: operating procedures (such as leaving equipment running or on standby); safety and maintenance procedures; relationships with particular suppliers; design criteria; specification and procurement procedures; equipment replacement routines and so on.
33. Montvalo, 2007, A11, organization capabilities refer to the firm's endowments and capabilities to carry out innovation… When the knowledge is not present in the firm adoption will depend on the firm's capacity to overcome shill lock-in, and to unlearn and acquire new skills. UNIDO, Inertia and the status quo bias: Routines can be surprisingly persistent and entrenched. … This type of problem has been labeled inertia within the energy efficiency literature and identified as a relevant explanatory variable for the efficiency gap.
34. Sardianou, 2007, p. 1419, Uncertainty about future energy prices (62%) is also characterized as a barrier [leading] to the postponement of energy efficiency measures.
35. Ito, 2010, p. 1, I find strong evidence that consumers respond to average price rather than marginal or expected marginal price.
36. UNIDO, 2011, p. 67, The government does not give financial incentives to improve energy efficiency, Lack of coordination between different government agencies, Lack of enforcement of government regulations, There is a lack of coordination between external organizations; Sardianou, 2007, p. 1402, [B]ureaucratic procedure to get government financial support is a barrier to energy efficiency improvements for the majority (80%) of industries.

EXHIBIT A-V-2: MARKET BARRIERS AND IMPERFECTION IN CLIMATE CHANGE ANALYSIS

TRADITIONAL ECONOMICS & INDUSTRIAL ORGANIZATION

EXTERNALITIES
Knowledge Externalities that are not captured by markets, e
Research and Development (20, 22, 23, 48, D), a, b
Importance of learning by searching (27, 31, 38, E), c
Deployment: Importance of learning by doing (27, 10, 31, 38, B), c
Economics of Scale/returns to scale (6, 38, 41, 47, G), d
Localization (24, 38, 45, H))

MARKET STRUCTURE:
Cost Structures: Long investment cycles, increasing returns to scale, network effects (8, 28, 33, 498 I)
Challenge of creating new markets: Undifferentiated product (20, 23, 28, 42, J)
Entry Barriers: Capital Cost, access to network (20, 41, 47 48, K)
Lack of competition hinders innovation (41, 48, L)
INERTIA:
Cost of Inertia (1, 14, 28, M)
Importance of inertia/stock of knowledge (9, 24, 37, 45, N)

NEW INSTITUTIONAL ECONOMICS

ENDEMIC
Perverse incentives: in allocation of fuel price volatility (20, 50, O), carbon tax level and permanence (21, 30, 40, 44, P) g
Asymmetric information (21, 48, Q)
Shot-term view, h, i

TRANSACTION COST
Uncertainty: as a cause of underinvestment (8, 21, 26, 43, 47, R)
Fuel price volatility, carbon tax level and permanence (fuel price volatility, carbon tax level and permanence (20, 33, S)
High risk premia on new technologies (28, T)
Information: Value of information (2, 22, U)
Sunk costs and embedded infrastructure (21, 48, V)
Incomplete markets f

POLITICAL POWER
Power of incumbents to hinder alternatives (20, 45, ZA)
Monopolistic structures and lack of competition (24, 39 41, 46, 47, ZB)
Importance of institutional support for Alternatives (22, 30, ZC)

BEHAVIORAL ECONOMICS

BEHAVIOR
Sluggish demand response (20, 23, W)
Agency (18, 8, X)
Risk Aversion (6, Y)
Calculation (17, 47, Z)

EFFECTIVE POLICY RESPONSES
Public goods (24, 49, ZC)
Institution Building (22, 30, 49, ZE)
Research and Development (5, 10, 20, 23, 25, 26, 28, 32, 35, 37, 47, ZF)
Capital subsidies Adders, premium prices (6, 41, ZG)
Obligations/Consenting (25, 28, 35, 47, M, (ZH)
Standards (8, 22, ZI)
Feed in Tariffs (28, 41, 45, 47, ZJ)
Merit order (20, 21, ZK)

EVIDENCE ON THE INEFFECTIVENESS OF PRICE/ TAX AS POLICY
Price Insufficiency (4, 11, 15, 20, 19, 25, 29, 35, 41, 47, 48 A)
Tax: Difficulty of setting and sustaining "optimal" levels (20, 19, 47, B)
Tradable permits do not increase innovation (5, 36, C)

Lower case letters (a) Raymond J. Kopp and William A Pizer, *Assessing U.S. Climate Policy Options* (Washington, D.C.: November 2007);
Upper case letters (A) keyed to the following climate change sources:

1 Acemoglu, Daron, et al., 2012, *"The Environment and Dedicated Technical Change," American Economic Review, 102(1*)
2 Baker, Erin and Yiming Peng, "The Value of Better Information on Technology R&D Programs in Response to -Climate change," *Environmental Model Assessment,* 17
3 Braun, Franked G., Jens Schmidt-Emcee and Petra Zloczyisti, 2010, Innovative *Activity in Wind and Solar Technology: Empirical Evidence on Knowledge Spillovers Using Patent Data,* Growth and Sustainability Polies for Europe, June
4 Breakthrough Journal, *Yale Environment 360 Debate, 2011*
5 Calel, Raphael and Antoine Dechexlepetre, *Environmental Policy and Directed Technological Change: Evidence from the European Carbon Market,* 2012
6 Chu, Shan-Ying, 2012, "Innovation and Diffusion of Wind Power in Taiwan," *Journal of Global Business Management*
7 DB Climate Change Advisor, Paying for Renewable Energy: TLC at the Right Price, December 2009
8 De Cian, Enrica and Tavoni Massimo, "Mitigation Portfolio and Policy Instruments When Hedging Again Climate Policy and Technological Uncertainty," *Environmental Model Assessment,* 2012:17.
9 Dechezleperte, Antoine, et al., 2011, *Climate change & Directed Innovation: Evidence from the Auto Industry, London School of Economics and Political Science*
10 Ek, Kristina and Patrik Soderholm, "Technology Learning in the Present of Public R&D: The Case of European Wind Power," *Ecological Economics,* 2010: 69
11 Fuss, Sabine and Jana Szolgayova, "Fuel Price and Technological Uncertainty in a real Option Model for electricity Planning," *Applied Energy,* 2010: 87
12 Fuss, Sabine et al., "Investment Under Market and Climate Policy Uncertainty, "Applied Energy, 85:208
13 Fuss, Sabine, et al. "Impact of Climate Policy Uncertainty on the Adoption of Electricity Generating Technologies, Energy Policy, 37: 2009

14 Gerlagh, Reyer, Snorre Kverndokk, and Knut Einar Rosendhal, 2009, "Optimal Timing of Climate change Policy: Interaction between Carbon Taxes and Innovation Externalities," *Environmental Resource Economics,* 43

15 Gerlgh, Reyer, "Measuring the Value of Induced Technological Change," *Energy Policy,* 35:2007

16 Greene, David, "Uncertainty, Loss Aversion, and Markets for Efficiency," *Energy Economics,* 2011:11

17 Greene, David, L., John German and Mark A. Deluchhi, "Fuel Economy: The Ace for Market Failure," in Daniel Sperling and James S. Cannon (eds.), *Reducing Climate Impacts in the Transportation Sector,* 2009

18 Greene, David, *Why the Market for New Passenger Cars Generally Undervalues Fuel Economy,"* OECD Joint Transport Research Centre, January 2010

19 Grimaudi, André and Gilles Laffrougue, *Climate Change Mitigation Policies: Are R&D Subsidies Preferable to a Carbon Tax,* Tolouse School of Economics, November 21, 2008

20 Gross, Robert, et al., *On Picking Winners: The Need for Targeted Support for Renewable Energy,* Imperial College London, October 2012

21 Gross, Robert, William Blyth and Philip Heponstall, "Risks, Revenues and Investment in Electricity Generation: why Policy Needs to Look Beyond costs," *Energy Economics,* 2010: 32.

22 Hoebach, Jon, "Determinants of Environmental Innovations -- New Evidence from German Panel Data Source," Research Policy, 37:2008

23 Jamasb, Tooraj, and Jonathan Kohler, *Learning Curves for Energy Technology: A Critical Assessment,* University of Cambridge, October 2007

24 Johnstone, Nick and Ivan Hascic, *Directing Technological Change while Reducing the Risk of (not) Picking Winners: The Case of Renewable Energy,* November 2010.

25 Johnstone, Nick, Ivan Hascic and David Popp, 2008, *Renewable Energy Policies and Technological Innovation: Evidence Based on Patent Counts,* National Bureau of Economic Research, January 2008.

26 Jouvet, Pierre-Andre, Elodie Le Cadre and Caroline Orset, "Irreversible Investment, Uncertainty, and Ambiguity: The Case of Bioenergy Sector," *Energy Economics,* 2012:34.

27 Kahouli Brahmi, Sondes, "Technological Learning in Energy-Environment-Economy Modeling: A Survey," *Energy Policy,* 2008:36.

28 Kalkuhl, Matthias, Ottmar Edenhofer, Kai Lessmann, "Learning or Lock-in: Optimal Technology Policies to Support Mitigation, *Resource and Energy Economics,* 2012:34

29 Kemp, Rene and Serena Pontoglio, "The Innovation Effects of Environmental Policy Instruments -- A Typical Case of the Blind Men and the Elephant?," Ecological Economics, 72: 2011

30 Kobos, Peter, H, Jon D. Erickson and Thomas E. Drennen, "Technological Learning and Renewable Energy Costs: Implications for US Renewable Energy Policy," Energy Policy, 34:2006

31 Lindman, Asa and Patrik Soderholm, "Wind Power Learning Rates: a conceptual Review and Meta-Analysis," *Energy Economics,* 2012:34.

32 Massetti, Emanuele and Lea Nicita, *The Optimal Climate Policy Portfolio,* CESifo working paper Energy and Climate Economics, No. 2988, 2010

33 Milstein, Irena and Sher Tishler, "The Inevitability of Capacity Underinvestment in Competitive electricity Markets," *Energy Economics,* 2012: 34.

34 Nicolli, Francesco and Francesco Vona, 2012, *The Evolution of Renewable Energy Policy in OECD Countries: Aggregate Indicators and Determinants, ofce.sciences*-po, Working Paper, 2012-13

35 Noailly, Joelle, 2012, "Improving Energy Efficiency of Building: The Impact of Environmental policy on Technological Innovation," *Energy Economics,* 34

36 Pielke, Roger, EU Decarbonization 1980 to 2010 and Non-Carbon Forcings, updating The Climate Fix, 2010. http://rogerpielkejr.blogspot.com/2012/01/eu-decarbonization-1980-to-2010-and-non.html,

37 Piscitello, Lucia, Paola Garrone and Yan Wang, 2012, *Cross Country Spillovers in the Renewable Energy Sector,* Druid Society, CBS, Copenhagen, June

38 Qui, Yeuming and Laura D. Anadon, 2012, "The Price of Wind in China During its Expansion: Technology Adoption, Learning-by-doing, Economies of Scale, and Manufacturing Localization," *Energy Economics, 34*

39 Requate, Till, "Dynamic Incentives by Environmental Policy Instruments," Ecological Economics, 54: 2005

40 Reuter, et. Al., "Renewable Energy Investment: Policy and Market Impacts," Applied Energy, 92:2012

41 Rubbeike, Dirk and Pia Weiss, *Environmental Regulations, Market Structure and Technological Progress in Renewable Energy Technology – A Panel Data Study on Wind Turbines,* Fonazione Eni Enrico Mattei, 2011

42 Sunderkotter, Malte and Christopher Weber, "Valuing Fuel Diversification in Power Generation Capacity Planning," *Energy Economics,* 2012:34.

43 Szolgayova, et al., "Robust Energy Portfolios Under Climate Policy and Socioeconomic Uncertainty," *Environmental Model Assessment, 17:2012*

44 Temperton, Ian, "Dining Out on Electricity Market Reform with Kylie, the Tooth Fairy and a Spherical Horse in a Vacuum," *Climate change Capital,* 2012

45 Toke, David, Sylvia Breukers and Maarten Wolsnik, "Wind Power Deployment Outcomes: How can we Account for the Differences?," *Renewable and Sustainable Energy Review,* 2008:12

46 Walz, R., "the Role of Regulation for Sustainable Infrastructure Innovation: the Case of Wind energy," *International Journal of Public Policy,* 2007

47 Walz, R., J. Scleich and M. Ragwitz, "Regulation, Innovation and Wind Power Technologies – An Empirical Analysis for OECD Countries, *DIME final Conference,* Maastricht, April 2011

49 Weyant, John P., "Accelerating the Development and Diffusion of New Energy Technologies: Beyond the Valley of Death," Energy Economics, 33: 2011

49 Wilson, Charlie, et al., "Marginalization of End Use Technologies in Energy Innovation for Climate Protection

50 Zorlu, Pelin, et al., Risk Managing Power Sector Decarbonization in the UK, E3G, October 2012

a) Public Goods:, Many technologies have competing or multiplicative (rather than additive) impact. The most compelling economics typically reside with the first abatement options in the analytical sequence. Pursuing energy efficiency in electric power, for example, has the potential to reduce the number of new coal-fired power plants needed (p. xx); The mismatch between near-term technology

investment and long-term needs is likely to be even greater in a situation where the magnitude of desired GHG reductions can be expected to increase over time. If more stringent emissions constraint will eventually be needed, society will benefit from near-term R&D to lower the cost of achieving those reductions in the future. Similarly, rationales for public support of technology demonstration projects tend to point to the… inability of private firms to capture the rewards for rewards for designing and constructing first-of-a-kind facilities. (p. 120)

(b) R&D tends to be underprovided in a competitive markets because its benefits are often widely distributed and difficult to capture by individual firms…. economics literature on R&D points to the difficulty firms face in capturing all the benefits from their investments in innovation, which tend to spill over to other technology producers and users.. (pp. 118-120); In addition, by virtue of its critical role in the higher education system, public R&D funding will continue to be important in training researchers and engineers with the skill necessary to work in either the public or private sector to product GHG-reducing technology innovations (p. 120)… Generic public funding for research tends to receive widespread support based on significant positive spillovers that are often associated with the generation of new knowledge. (p. 136).

(c) "Another potential rationale involves spillover effects that he process of so-called "learning-by-doing" – a term that describes the tendency for production costs to fall as manufacturers gain production experience."(p. 136)

(e) Network Effects: Network effects provide a motivation for deployment policies aimed at improving coordination and planning – and where appropriate, developing compatibility standards – in situations that involve interrelated technologies, particularly within large integrated systems (for example, energy productions, transmission, and distribution networks). Setting standards in a network context may reduce excess inertia (for example, the so-called chicken-and-egg problems with alternative fuel vehicles), while simultaneously reducing search and coordination costs, but standard scan also reduce the diversity of technology options offered and may impede innovation over time. (p. 137)

(e) Similarly, rationales for public support of technology demonstration projects tend to point to the large expense; (p.120).

(f) Similarly, rationales for public support of technology demonstration projects tend to point to the large expense; high degree of technical, market and regulatory risk; and inability of private firms to capture the rewards for rewards for designing and constructing first-of-a-kind facilities. (p. 120)

(g) Finally, incomplete insurance markets may provide a rationale for liability protection or other policies for certain technology options (for example, long-term CO_2 storage). (p. 137)

(h) Regulatory risk: Similarly, rationales for public support of technology demonstration projects tend to point to the… high degree of technical, market and regulatory risk. The problem of private-sector under investment in technology innovation may be exacerbated in the climate context where the energy assets involved are often very-long lives and where the incentives for bringing forward new technology rest heavily on domestic and international policies rather than natural market forces. Put another way, the development of climate-friendly technologies has little market value absent a sustained, credible government commitment to reducing GHG emissions. (p. 120)

g) The mismatch between near-term technology investment and long-term needs is likely to be even greater in situation where the magnitude of desired GHG reductions can be expected to increase over time. If more stringent emissions constraint will eventually be needed, society will benefit from near-term R&D to lower the cost of achieving those reductions in the future. (p. 120)."

h) Finally, incomplete insurance markets may provide a rationale for liability protection or other policies for certain technology options (for example, long-term CO_2 storage, (p.137)."

i) The problem of private-sector under investment in technology innovation may be exacerbated in the climate context where the energy assets involved are often very-long lives and where the incentives for bringing forward new technology rest heavily on domestic and international policies rather than natural market forces… "Put another way, the development of climate-friendly technologies has little market value absent a sustained, credible government commitment to reducing GHG emissions (p.12).

A Walz, Schleich and Ragwitz, 2011, p. 16, Power prices, however, are not found to drive patent activity. Hence power prices alone would likely not be sufficient to spur innovation activities in wind and arguably also other, currently less cost-efficient renewable technologies.

B The stability and long term vision of policy target setting are important policy style variables, which contribute to the legitimacy of technology and provide guidance of search…

C Calel and Dechezloprete, 2012, p. 1. "[M]ore refined estimates that combine matching methods with different-in-difference provide evidence that the EU ETS has not impacted the direction of technological change. This finding appears to be robust to a number of stability and sensitivity checks. While we cannot completely rule out the possibility that the EU ETS has impacted only large companies for which suitable unregulated comparators cannot be found, our findings suggest that the EU ETS so far has had at best a very limited impact on low-carbon technological change.

D Massetti and Nicita, 2010, p. 1The presence of market failures in the R&D sector, as emphasized by Griliches, is confirmed by the evidence, virtually found in all studies, that the social rate of return on R&D expenditure is higher than the corresponding private rate; estimates of the marginal social rate of return on R&D range between 30 and 50 percent and of private return between 7 and 15 percent… When it comes to technologies for carbon emissions reduction, the difference between private and social rate of return to R&D investment arises from a double externality; the presence of both environmental and knowledge externalities. First, without a price on carbon that equates the global and the private cost of emitting GHGs, all low emissions technologies are relatively disadvantaged and the level of investment is therefore sub-optimal. Second, the private return to investment in R&D is lower than the social return of investment due to the incomplete appropriability of knowledge creation, thus pushing further away investment for the socially optimal level.

E Massetti and Nicita, 2010, p. 17, We find that a [carbon] stabilization policy together with an R&D policy targeted at the only energy sector is significantly less costly than the stabilization policy alone. We find that energy R&D does not crowd-out non-energy R&D, and thanks to intersectoral spillovers, the policy induced increase in energy efficiency R&D spills over to the non-energy sector, contributing to knowledge accumulation and the reduction of knowledge externalities.

F Gross, et al., p.18, The phenomenon of "learning by doing", whereby costs for technologies reduces as experience is gained from deployment of the technology creates lock-in. It also creates better, cheaper technologies. The incumbent fossil and nuclear forms of generation have had many decades of technical refinement through experience which have driven their costs down to low levels relative to new, renewable technologies. In part, this was financed by considerable public subsidy… The very same effects that created lock-in to high carbon systems offer the potential to decrease the costs and improve the commercial/consumer attractiveness of new forms of low carbon energy.

G Qui and Anadon, pp. 782, The size of the wind farm is another significant factor in all specifications… indicate that a doubling in wind farm size could lead to price reductions of about 8.9%.

H Qui and Anadon, pp. 782, Localization rate is a significant factor in all specifications… indicate that a doubling of localization rate was associated with reductions in wind electricity price ranging from 10.9% to 11,4%.

I Cian and Massimo, 2011, p. 123, Uncertainty and irreversibility are two features of climate change that contribute to shape the decision making process. Technology cost uncertainty can depress the incentive to invest. The risk of underinvestment is even more severe considering that energy infrastructure has a slow turnover. Capital irreversibility and uncertainty heighten the risk of locking into existing fossil-fuel-based technologies. Additional investments are sunk costs that increase the opportunity cost of acting now… The result is reinforced when uncertain costs have a large variance, showing that investments decrease with risk. Jamasb and Nicita, (2007, p 8) R&D activity can be subject to three main types of market failure namely indivisibility, uncertainty and externalities.

J J. Kalkuhl, Edenhofer and Lessmann, 2012, p. 10, The energy sector is highly vulnerable to lock-in because electricity is an almost perfect substitute for consumers. In contrast, many innovations in the manufacturing or entertainment electronics sector provide a new product different from existing ones (e/g/ flat screens vs. CRT monitor). The low substitutability implies a high niched demand and, thus, provokes ongoing learning-by-doing although considerable spillovers exist and market prices are distorted.

K K. Gross, et al. 2012, p. 18, In the energy sector, such "network externalities" rise for example in the physical structures of large scale high voltage alternating current (AC) power grids themselves (themselves a reminders of early energy planners' desire to locate power stations close to the source of coal) which now provides a cost advantage to large scale centralized station over distributed alternatives.

L Gross, et al., 2012, p. 10, Either policymakers around the world are blind to the logic of economic theory, or there are factors that overwhelm or undermine the theoretical Pigouvian considerations. The rest of this paper discusses the considerations t

M Grimaud and Lafforgue, 2008, p. 1…20,The main results of the paper are the following: i) both a carbon tax and a green research subsidy contribute to climate change mitigation; ii) R&D subsidies have a large impact on the consumption, and then social welfare, as compared to the carbon tax alone; IV) those subsidies allow to spare the earlier generations who are, on the other hand, penalized by a carbon tax….In a second-best world, a carbon tax used alone leads to a higher social cost (with respect to first-best) than a research policy alone;

N Jamasb and Kohler, 2007, p. 9, Information technology and pharmaceuticals, for example, are both characterized by high degrees of innovation, with rapid technological change financed by private investment amounting typically to 10-20% of sector turnover. This is in dramatic contrast with power generation, where a small number of fundamentals technologies have dominated for almost a century and private sector RD&D has fallen sharply with privatization of energy industries to the point where it is under 0.4% of turnover.

O Gross, et al., 2012, p. 14, Capital intensive, zero fuel cost power stations like wind farms, need to cover their long run average costs—namely the cost of capital. They can neither actively affect/set marginal power prices nor respond to power price changes, except to curtail output, which does not save costs (as there are no fuel cost to save), but does lose revenue. However, carbon prices only affect the marginal price of fuel and power. We should therefore expect that an emissions trading scheme will encourage fuel switching from coal to gas, and efficiency first and renewable energy (or indeed nuclear) investment last. This is exactly what we have seen in reality.

P Reuter, et al., 2012, p. 253, If there is uncertainty about the future development of feed-in-tariffs, much higher levels will be needed to make renewable investment attractive for energy companies.

Q Gross, 210, p. 802, "A range of factors that relate to the amount and quality of information about technology costs and risks available to policymakers and market participants are relevant when considering incentives and investment in new technologies: Policymakers may have relatively poor information about costs for emerging technologies. 'Appraisal optimism' (where technology/project developers under estimate the cost of unproven technology/systems) is a common feature in the development of new technologies. When providing cost data to policymakers technology developers or equipment suppliers may also have incentives to up or play down costs and potential according to circumstances. Where new or unproven technologies are being utilized for the first time, information about costs may be limited for all concerned... There may be an 'option value' to potential investors in waiting (delaying investment) where there is poor information and high levels of technology and market risk. The first conclusion is that policymaking in the energy area needs new tools of analysis that can deal with the market risks associated with policy design… In particular, policymakers need to be mindful of the role of revenue risk as well as cost risk in the business case for investment.

R Fuss and Szolgayosva, 2010, p.2938, We find that the uncertainty associated with the technological progress of renewable energy technologies leads to a postponement of investment. Even the simultaneous inclusion of stochastic fossil fuel prices in the same model does not make renewable energy competitive compared to fossil-fuel-fired technology in the short run based on the data used. This implies that policymakers have to intervene if renewable energy is supposed to get diffused more quickly. Otherwise, old fossil-fuel-fired equipment will be refurbished or replaced by fossil-fuel-fired capacity again, which enforces the lock-in of the current system into unsustainable electricity generation.

S Gross, et al., 2012, In short,, whilst carbon pricing can create conditions that make investment in wind more attractive, there are uncertainties associated with wholesale power prices, carbon permit prices, and future political decisions on carbon tax levels. These make wind investment more risky, which drives up the cost of capital investors require higher returns), and discourage investment.

T Gross, Blyth and Heponstall, 2012, p. 802.The first conclusion is that policymaking in the energy area needs new tools of analysis that can deal with the market risks associated with policy design… In particular, policymakers need to be mindful of the role of revenue risk as well as cost risk in the business case for investment.

U Horbach, 2007, p. 172, Environmental management tools help to reduce the information deficits to detect cost savings (especially material and energy savings) that are an important driving force of environmental innovation.

V Weyant, 2011, p. 677, The infrastructure for producing, distributing, and promoting the industries' current products require large investments that have already been incurred.

W Jamasb and Kohler, 2007, Thus, the 'market pull' forces reach deep into the innovation chain…This is in contrast with power generation, where a small number fundamental and private sector RD&D has fallen sharply with privatization of energy industries. technologies have dominated for almost a century and private RD&D has fallen sharply with privatization... In turn, market pull measures are devised to promote technical change by creating demand and developing the market for new technologies.

X Weyant, 2011, p. 675, The situation can develop from several different types of market failure, including poor or asymmetric information available to purchasers, limits on individual's ability to make rational decisions because of time or skill constraints, principle agent incongruities... and lack of financing opportunities.

Z Green, 2010, p. 6, The rational economic consumer considers fuel saving over the full life of a vehicle, discounting future fuel savings to present value. This requires the consumer to know how long the vehicle will remain in operation; he distances to be traveled in each future year, the reduction in the rate of fuel consumptions, and the future price of fuel…. The consumer must also estimate the fuel economy that will be achieved in real world driving based on the official estimate. Finally, the consumer must know how to make a discounted present value calculation, or must know how to obtain one… The utility-maximizing rational consumer has fixed preferences, possesses all complete and accurate information about all relevant alternatives, and has all the cognitive skills necessary to evaluate the alternatives. These are strict requirements indeed….

ZA Nicolli and Vona, p. 1, Our empirical results are consistent with predictions of political-economy models of environmental policies as lobbying, income and to a less extent, inequality have expected effects on policy. The brown lobbying power, proxied by entry barriers in the energy sector, has negative influence on the policy indicators even when taking into account endogeneity in its effect. The results are also robust to dynamic model specifications and to the exclusion of groups of countries

ZB Weyant, 2011, p. 677, Further complicating matters, existing companies in energy-related industries --- those that produce energy, those that manufacture the equipment that produces, converts and uses energy, and those that distribute energy – can have substantial incentives to delay the introduction of new technologies. This can happen if their current technologies are more profitable than the new ones that might be (or have been) invented, or if they are in explicitly (oil and gas) or implicitly (electric generation equipment producers and automakers) oligopolistic structured, or if they are imperfectly regulated (electric and gas utilities). The incentive arises partly because the infrastructure for producing, distributing, and promoting the industries' current products require large investments that have already been incurred.

ZC Horbach, 2008, p. 172, An environmentally oriented research policy has not only to regard traditional instruments like the improvement of the technological capabilities of a firm but also the coordination with soft environmental policy instruments like the introduction of environmental management systems.

ZD Johnstone and Haccic, 2010, p.25 "Since innovating in storage technologies is an important complement to innovation in all intermittent renewable generating technologies such a strategy reduces the risk of (not) picking winners. Moreover, the technologies are at a relatively early stage of development, with greater need for support.

ZE Wilson, et al., p. 781, The institutions emphasized in our analytic framework are twofold: the propensity of entrepreneurs to invest in risky innovation activities with uncertain pay-offs; and shared expectation around an innovation's future trajectory. Other important and related institutions include law, markets and public policy. Public resources are invested directly into specific innovation stages, or are used to leverage private sector resources through regulatory or market incentives structured by public policy…. New technologies successfully diffuse as a function of their relative advantage over incumbent technologies. For energy technologies, this can be measured by the difference in cost and performance of energy service provision in terms of quality, versatility, environmental impact and so on. Many of these attributes of relative advantage can be shaped by public policy as well as the other elements of the innovation system.

ZF Walz, Schleich and Ragwitz, 2011, p. 5, The specific advantage of feed-in tariffs is seen in lower transaction costs and reduced risk perception for investors and innovators, which are extremely important especially for new entrants and for financial institutions.

ZH Walz, Schleich and Ragwitz, 2011, p. 16, Our econometric analyses also imply that the existence of targets for renewables/wind and a stable policy support environment are associated with higher patent activity.

ZI de Chien and Massimon, 2012, pp. 13…15, Against this evidence, regulation such as Emissions Performance Standards (EPS) that set a maximum threshold for the emission intensity of power generation in terms of grams of CO2 per kilowatt hour could be justified as a way to reduce uncertainty exposure... [W]e have also pointed out that the optimal penetration of renewables is slow, even when facing a given deterministic carbon price.

ZG Rubbeike and Weiss, 2011, Including non-price-based variable increases the fit of the model… the coefficients for grants is positive and highly significant.

ZJ Gross, Blyth and Heptonstall, 2010, 802,The international evidence suggests that in most cases countries with fixed price schemes have been more successful at deploying renewables than those with trading scheme. Whilst the reasons for this are complex and varied it appears likely that investment r k plays an important role.

ZK Gross, Blyth and Heptonstall, 2010, 798,The result is that significant long-run fuel price uncertainty.. cannot usually be hedged through contractual arrangements. Long-run fuel price changes, like time of day rates, are mediated by the current market arrangements but remain fundamental to electricity prices.

EXHIBIT A-V-3: CAUSES OF CARBON LOCK-IN

Business Innovation Risk – Cost Effectiveness and Fiscal Barriers	Incumbent Support
Technical risk Volatile Energy Prices Market risk High up-front costs	Industry structure Inadequate supply chain Monopoly power
Transaction Costs	**Policy Obstacles – Regulatory/Statutory barriers**
Inadequate workforce/infrastructure Misinformation Imperfect information Lack of specialized Inadequate validation	Unfavorable policy environment Unfavorable regulation Uncertain Regulations Burdensome Permitting Uncertain/Unfavorable fiscal policy Misplaced incentives

Cost-Effectiveness Barriers

External Benefits and Costs: External benefits of GHG-reducing technologies that the owners of the technologies are unable to appropriate (e.g., GHG emission reductions from substitutes for high GWP gases and carbon sequestration).

External costs associated with technologies using fossil fuels (e.g., GHG emissions and health effects from small particles) making it difficult for higher priced, GHG-reducing technologies to compete.

High Costs: High up-front costs associated with the production and purchase of many low carbon technologies; high operations and maintenance costs typical of first-of-a-kind technologies; high cost of financing and limited access to credit especially by low-income households and small businesses.

Technical Risks: Risks associated with unproven technology when there is insufficient validation of technology performance. Confounded by high capital cost, high labor/operating cost, excessive downtime, lack of standardization, and lack of engineering, procurement and construction capacity, all of which create an environment of uncertainty.

Market Risks: Low demand typical of emerging technologies including lack of long-term product purchase agreements; uncertainties associated with the cost of a new product vis-à-vis its competitors and the possibility that a superior product could emerge; rising prices for product inputs including energy feedstocks; lack of indemnification.

Lack of Specialized Knowledge: Inadequate workforce competence; cost of developing a knowledge base for available workforce; inadequate reference knowledge for decision makers.

Fiscal Barriers

Unfavorable Fiscal Policy: Distortionary tax subsidies that favor conventional energy sources and high levels of energy consumption; fiscal policies that slow the pace of capital stock turnover; state and local variability in fiscal policies such as tax incentives and property tax policies. Also includes various unfavorable tariffs set by the public sector and utilities (e.g., import tariffs for ethanol and standby charges for distributed generators) as well as unfavorable electricity pricing policies and rate recovery mechanisms.

Fiscal Uncertainty Short-duration tax policies that lead to uncertain fiscal incentives, such as production tax credits; uncertain future costs for GHG emissions.

Regulatory Barriers

Unfavorable Regulatory Policies: Distortionary regulations that favor conventional energy sources and discourage technological innovation, including certain power plant regulations, rules impacting the use of combined heat and power, parts of the federal fuel economy standards for cars and trucks, and certain codes and standards regulating the buildings industry;

burdensome and underdeveloped regulations and permitting processes; poor land use planning that promotes sprawl.

Regulatory Uncertainty: Uncertainty about future regulations of greenhouse gases; uncertainty about the disposal of spent nuclear fuels; uncertain siting regulations for off-shore wind; lack of codes and standards; uncertainty regarding possible future GHG regulations.

Statutory Barriers

Unfavorable Statutory Policies: Lack of modern and enforceable building codes; state laws that prevent energy saving performance contracting.

Statutory Uncertainty: Uncertainty about future statutes including renewable and energy efficiency portfolio standards; unclear property rights relative to surface injection of CO_2, subsurface ownership of CO_2 and methane, and wind energy.

Intellectual Property Barriers

High Intellectual Property

Transaction Costs: High transaction costs for patent filing and enforcement, conflicting views of a patent's value, and systemic problems at the USPTO.

Anti-competitive Patent Practices Techniques such as patent warehousing, suppression, and blocking.

Weak International Patent Protection: Inconsistent or nonexistent patent protection in developing countries and emerging markets.

University, Industry, Government Perceptions: Conflicting goals of universities, national laboratories, and industry concerning CRADAs and technology commercialization.

Other Barriers

Incomplete and Imperfect Information: Lack of information about technology performance – especially trusted information; bundled benefits and decision-making complexities;

High cost of gathering and processing information; misinformation and myths; lack of sociotechnical learning; and lack of stakeholders and constituents.
Infrastructure Limitations: Inadequate critical infrastructure – including electric transmission capabilities and long-term nuclear fuel storage facilities; shortage of complementary technologies that encourage investment or broaden the market for GHG-reducing technologies;
insufficient supply and distribution channels; lack of O&M facilities and other supply chain shortfalls.
Industry Structure: Natural monopoly in utilities disenabling small-scale competition;
Industry fragmentation slowing technological change, complicating coordination, and
limiting investment capital.
Misplaced Incentives: Misplaced incentives when the buyer/owner is not the consumer/user (e.g., landlords and tenants in the rental market and speculative construction in the buildings industry) – also known as the principal-agent problem.
Policy Uncertainty: Uncertainty about future environmental and other policies; lack of leadership

Marilyn A. Brown, et al., *Carbon Lock-In: Barriers to Deploying Climate Mitigation Technologies,* Oak ridge National Laboratory, January 2008.

BIBLIOGRAPHY

Acemoglu, Daron, et al., 2012, "The Environment and Dedicated Technical Change," *American Economic Review,* 102(1)

Affhammer, Maximillian and Alan H. Sanstad, 2011, *Energy Efficiency in the Residential and Commercial Sectors,* Resources for the Future and National Energy Policy Institute, January.

Air, Don , 2010, *Delivering Jobs: The Economic Costs and Benefits of Improving the Fuel Economy of Heavy-Duty Vehicles,* Union of Concerned Scientists, May.

Akash, B and M. Mohsen, "Current Situation of Energy Consumption in the Jordanian Industry," *Energy conservation and Management,* 44(9).

Allcott, Hunt, 2010, *Beliefs and Consumer Choice,* November.

Allcott, Hunt and Michael Greenstone, 2012, "Is there an Energy Efficiency Gap?" *Journal of Economic Perspectives,* 26.

Allcott, Hunt and Nathan Wozny, 2011, *Gasoline Prices, Fuel Economy and the Energy Paradox?",* MIT, Working Paper.

Amann, Jennifer Thorne, 2006, *Valuation of Non-Energy Benefits to Determine Cost-Effectiveness of Whole-House Retrofit Programs: A Literature Review,* American Council for an Energy Efficient Economy, May.

Anair, Don and Jamie Hall, 2010, *Delivering Jobs: The Economic Costs and Benefits of Improving the Fuel Economy Heavy-Duty Vehicles,* Union of Concerned Scientists, May.

Appliance Standards Awareness Project, 2013a, "Standards Scene Heating Up," *Appliance Standards Unplugged, July 25.*

Appliance Standards Awareness Project, 2013b, "California Preps for New Rulemaking," *Appliance Standards Unplugged, July 25.*

Appliance Standards Awareness Project, 2013c, "State of the States," *Appliance Standards Unplugged,* July 25.

Arimura, Tosi H., Richard G. Newell and Karen Palmer, 2009, *Cost Effectiveness of Electricity Energy Efficiency Programs,* Resources for the Future, November.

Arvantis, Spyros, "Factors Determining the Adoption of Energy Saving Technologies in Swiss Firms: An Analysis Based on Micro Data, *Environmental Resource Economics,* September 16.

Atari, et al, 2011, "Public Perceptions of Energy Consumption and Savings," *PNAS Early Edition,* July 12.

Avent, Ryan, 2011, "Creating the Clean Economy," *The Economist,* June 11.

Baker, Erin and Yiming Peng, 2012, "The Value of Better Information on Technology R&D Programs in Response to Climate change," *Environmental Model Assessment,* 17.

Barker, Terry, Paul Eakins and Tim Foxon, "The Macro-economic Rebound Effect in the UK Economy," *Energy Policy,* 35.

Basel, Jon and Rolf Bruhl, 2011, *Concepts of Rationality in Management Research: From Bounded Rationality to Ecological Rationality,* ESCP, Europe.

Belke Ansgar, Christian Dreger and Frauke de Haan, 2011, *Energy Consumption and Economic Growth: New Insights into the Cointegrtion Relationship,* RUHR Economic Paper #190.

Bernstein, Mark, et al., 2000, *The Public Benefit of California's Investments in Energy Efficiency,* Rand.

Bing, Jing, 2011, "Social Learning and Dynamic Pricing of Durable Goods," *Marketing Science.*

Blumstein, Carl and Margaret Taylor, 2013*, Rethinking the Energy-Efficiency Gap,: Producers, Intermediaries and Innovation,* Energy Institute at Hass, May.

Bornstein, Severin, 2013, *A Microeconomic Framework for Evaluating Energy Efficiency Rebound and Some Implications,* Energy Institute at HAAS, May.

Braun, Frank G., Jens Schmidt-Emcee and Petra Zloczyisti, 2010, *Innovative Activity in Wind and Solar Technology: Empirical Evidence on Knowledge Spillovers Using Patent Data,* Growth and Sustainability Polies for Europe, June.

Breakthrough Journal, 2011, *Yale Environment 360 Debate.*

Brophy, Aoife, et al., 2010, *Demand-Side Management Strategies and the Residential Sector: Lessons from International Experience,* University of Cambridge, Electricity Policy Research Group, November.

Brown, Richard, Sam Borgeson, Jon Koomey and Peter Biermayer, 2008, *U.S. Building-Sector Energy Efficiency Potential,* Lawrence Berkeley National Laboratory, September.

Brown, Jennifer, Tanjim Hossain and John Morgan, 2007, *Shrouded Attributes and Information Suppression: Evidence from the Field,* November.

Brown, Marilyn A. et al., 2008, *Carbon Lock-In: Barriers to Deploying Climate Mitigation Technologies,* Oak ridge National Laboratory, January.

Brown, Rick, 1992, "Managing the "S" Curves of Innovation," *Journal of Consumer Marketing,* 9.

Bureau of Labor Statistics, *Consumer Expenditure Survey,* various issues.

Calel, Raphael and Antoine Dechezlepetre, 2012, *Environmental Policy and Directed Technological Change: Evidence from the European Carbon Market.*

California Energy Commission, 2012, "Energy Commission Approves More Efficient Building for California's Energy Future," May.

Cambridge Centre for Climate Mitigation Research, 2006, *The Macro-economic Rebound Effect and the UK Economy,* Cambridge Econometrics and Policy Studies Institute, May 15.

Carrico, Amanda R., et al., 2011, "Energy and Climate Change: Key Lessons for Implementing the Behavioral Wedge," *Journal of Energy & Environmental Law,* Winter.

Chatterjee, Dhiman and V.C. Ramseh, 1999, "Real Options for Risk Management in Information Technology Projects, *32nd Hawaii International Conference on System Sciences*

Chatterjee, R. and J. Wliashberg, 1990, "The Innovation Diffusion Process in a Heterogeneous Population: A Micromodeling Approach," 36, September.

Chu, Shan-Ying, 2012, "Innovation and Diffusion of Wind Power in Taiwan," *Journal of Global Business Management.*

Cicchetti, Charles, J., 2009, *Going Green and Getting Regulation Right: A Primer for Energy Efficiency,* Public Utilities Reports.

Claudy, Marius and Aidan O'Driscoll, 2008, "Beyond Economics: A Behavioral Approach to Energy Efficiency in Domestic Buildings," *Journal of Sustainable Energy Development*, 1.

Committee On Health, Environmental, And Other External Costs And Benefits Of Energy Production And Consumption, Board On Science, Technology, And Economic Policy, 2011, *Hidden Costs Of Energy: Unpriced Consequences Of Energy Production And Use,* National Research Council.

Committee to Asses Fuel Economy for Medium and Heavy Duty Vehicles, 2010, *Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles,* National Research Council.

Consumer Federation of America, 2010, *National Survey Shows that Most Consumers Support 60 MPG Fuel Economy Standards by 2025*, 09/28/10.

Consumer Federation of America, 2011a, *CFA Surveys Reveal Record Public Concern About Gas Prices and Dependence on Oil Imports,* 03/16/11.

Consumer Federation of America, 2011b, *CFA Appliance Efficiency Report* , 03/08/11.

Consumer Federation of America, 2011c, *CFA Comments to DOE on Equipment Price Forecasting for Refrigerators, Refrigerator-freezers and Freezers,* 03/24/11.

Consumer Federation of America, 2011d, *CFA and NCLC Letter to DOE Regarding Energy Conservation Standards for Residential Furnaces, Central Air Conditioners and Heat Pumps,* 10/17/11.

Consumer Federation of America, 2011e, *Comments to DOE on Set Top Boxes and Network Equipment as a Covered Consumer Product*, 09/22/11.

Consumer Federation of America, 2012, *CFA Joins Coalition in Comments to DOE on Efficiency Standards for Battery Chargers,* 07/16/12.

Consumer Federation of America, 2013,*Comments to DOE Urging Action to Advance New Lighting Standards,* 05/13/2013.

Consumer Federation of America, et al., 2012, *Comments on the Proposed Rule 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards*, Docket Nos. EPA-HQ-OAR-2010-0799; FRL-9495-2, NHTSA–2010–0131, 2/13/12.

Consumer Reports, 2010, *Energy Efficiency Poll,* July 1.

Consumer Reports, 2012, *Auto Pulse #26: Fuel Economy,* April 26.

Cooper, Mark, 1980a, *The Basics of BEPS: A Descriptive Summary of the Major Elements of the Department of Energy's Building Energy Performance Standards,* Consumer Energy Council of America, February.

Cooper, Mark, 1980b, "Energy and Jobs: The Conservation Path to Fuller Employment," *Conference on Energy and Jobs conducted by the Industrial Union Department of the AFL-CIO,* May.

Cooper, Mark, 1981a, *A Comprehensive Analysis of the Costs and Benefits of Low Income Weatherization and Its Potential Relationship to Low Income Energy Assistance,* Consumer Energy Council of America, June.

Cooper, Mark, 1981b, *Summary of Market Inhibitors*, Consumer Energy Council of America, February.

Cooper, Mark, 1982a, "Policy Packaging for Energy Conservation: Creating and Assessing Policy Packages," in Jeffrey Harris and Jack Hollander (Eds.), *Improving Energy Efficiency in Buildings: Progress and Problems,* American Council for An Energy Efficient Economy, 1982.

Cooper, Mark, 1982b, "Energy Efficiency Investments in Single Family Residences: A Conceptualization of Market Inhibitors," in Jeffrey Harris and Jack Hollander (Eds.), *Improving Energy Efficiency in Buildings: Progress and Problems*, American Council for An Energy Efficient Economy, 1982).

Cooper, Mark, 2008, *Comment of the Consumer Federation of America, on National Highway Traffic Safety Administration Notice of Proposed Rulemaking;* Docket No. NHTSA 2008-0089, RIN 2127-AK29; Average Fuel Economy Standards, Passenger Cars and Light Trucks; Model Years 2011-2015, July 1.

Cooper, Mark and Barbara Roper, 2009, *Reform Of Financial Markets The Collapse of Market Fundamentalism and the First Steps to Revitalize the Economy,* Consumer Federation of America, April.

Cooper, Mark, 2009b, *Comments of the Consumer Federation of America, Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*, Department of Transportation, Environmental Protection Agency, 40 CFR Parts 86 and 600, 49 CFR Parts 531,633, 537, et al., November 28.

Cooper, Mark, 2011a, *Comments of Consumer Federation of America and Consumer Groups, Proposed Rule 2017 and Later Model Year,* Docket Nos. Light-Duty Vehicle Greenhouse Gas Emissions, EPA-HQ-OAR-2010-0799; FRL-9495-2 and Corporate Average Fuel Economy Standards, NHTSA–2010–0131, February 13

Cooper, Mark, 2011b, *Comments of the Consumer Federation of America, Equipment Price Forecasting for Refrigerators, Refrigerator-freezers and Freezers,* Re: Docket Number EE–2008–BT–STD–0012, March 24.

Cooper, Mark, 2011c, Testimony of Dr. Mark Cooper on the American Energy Initiative before the House Energy and Commerce Committee, 03/17/11.

Cooper, Mark, 2011d, Testimony on Appliance Efficiency Standards Legislation, 03/10/11

Cooper, Mark, 2011e, *Prudent Resource Acquisition in a Complex Decision Making Environment: Multidimensional Analysis Highlights the Superiority of Efficiency,* 2011e, American Council For An Energy Efficient Economy, National Conference on Energy Efficiency as a Resource, September 26.

Cooremans, Catherine, 2009, "The Role of Formal Capital Budgeting Analysis in Corporate Investment Decision-making: A Literature Review," *ECEEE 2009 Summer Study.*

Dale et al, 2009, "Retrospective Evaluation of Appliance Price Trends," *Energy Policy* 37.

Davis, Luca W., 2010, *Evaluating the Slow Adoption of Energy Efficient Investments: Are Renters Less Likely to Have Energy Efficiency Appliance?*, Energy Institute at Haas, June.

DB Climate Change Advisor, 2009, *Paying for Renewable Energy: TLC at the Right Price,* December.

De Cian, Enrica and Tavoni Massimo, 2012, "Mitigation Portfolio and Policy Instruments When Hedging Again Climate Policy and Technological Uncertainty," *Environmental Model Assessment,* 17.

Dechezleperte, Antoine, et al., 2011, *Climate Change & Directed Innovation: Evidence from the Auto Industry, London School of Economics and Political Science.*

Desroches, Loius-Benoit, et al., 2011, *Incorporating Experience Curves in Appliance Standards Analysis,* Lawrence Berkeley Laboratory, October 31.

Diederen, Paul, Frank Van Tongeren and Hennie Van Der Veen, 2003, Returns on Investments in Energy-saving Technologies Under energy Price Uncertainty in Dutch Greenhouse Horticulture," *Environmental and Resource Economics,* 24.

Doblinger, Claudia and Birhe Soppe, 2011, *The Role of Social Movements in Legitimating New Technologies: Evidence from the Electric Utility Industry,* DIME-DRUID Academy Winter Conference, January 20-22.

Edelstein, Paul and Lutz Kilian, 2009, "How Sensitive are Consumer Expenditures to Retail Energy Prices?," *Journal of Monetary Economics,* 56.

Ek, Kristina and Patrik Soderholm, 2010, "Technology Learning in the Presence of Public R&D: The Case of European Wind Power," *Ecological Economics,* 69.

Eldridge, Maggie, et al., 2006, Th*e State Energy Scorecard for 2006,* American Council for and Energy Efficient Economy, June 1.

Engel, Ditlev and Sanial M. Kammen, 2009, *Green Jos and the Clean Energy Economy,* Copenhagen Climate Council,

Ernst Worrell, et al., 2003, "Productivity Benefits of Industrial Energy Efficiency Measures," *Energy Journal*, 11.

Executive Office of the President, 2013, *The President's Climate Action Plan,* June.

Fenn, Jackie, 1995, Whe*n to Leap on the Technology Hype Cycle,* Gartner Group.

Foster, Ben, et al., 2012, *The 2012 State Energy Efficiency Scoreboard*, American Council for an Energy Efficient Economy, October.

Freidrich, Katherine, et al., 2009, *Saving Energy Cost Effectively: A National Review of the Cost of Energy Saved through Utility-Sector Energy Efficiency Programs,* American Council for an Energy Efficient Economy, September.

Fuss, Sabine and Jana Szolgayova, 2010, "Fuel Price and Technological Uncertainty in a Real Option Model for Electricity Planning," *Applied Energy,* 87.

Fuss, Sabine et al., 2008, "Investment Under Market and Climate Policy Uncertainty, "*Applied Energy,* 85.

Fuss, Sabine, et al., 2009, "Impact of Climate Policy Uncertainty on the Adoption of Electricity Generating Technologies, *Energy Policy,* 37.

Gabaix, Xavier and David Laibson, 2005, *Shrouded Attributes, Consumer Myopia, and Information Suppression I Competitive Markets,* NBER Working Paper 11755, November.

Gartner Group, 2013, *Interpreting Technology Hype.*

Geller, H. P. Harrington, A.H. Rosenfeld, and S. Tanishim, 2006, Polices for Increasing Energy Efficiency: Thirty years of Experience in OECD Countries, *Energy Policy*, November.

Gerlagh, Reyer, 200, "Measuring the Value of Induced Technological Change," *Energy Policy,* 35.

Gerlagh, Reyer, Snorre Kverndokk, and Knut Einar Rosendhal, 2009, "Optimal Timing of Climate Change Policy: Interaction between Carbon Taxes and Innovation Externalities," *Environmental Resource Economics,* 43.

Gigerenzer, Gerd and Wolfgang Gaissaeir, 2011, "Heuristic Decision Making," *Annual Review of Psychology,* 62.

Gilder, Paul and Gerard J. Tellis, 1997, "Will it Ever Fly? Modeling the Takeoff of Really New Consumer Durables," *Marketing Science,* 16: .

Gilder, Paul and Gerard J. Tellis, 2004, "Growing, Growing Gone: Cascades, Diffusion, and Turning Points in the Product Life Cycle," *Marketing Science,* 23.

Gillingham, Kenneth, Matthew Harding and David Rapson, 2012, "Split Incentives in Residential Energy Consumption," *The Energy Journal,* 33.

Gillingham, Kenneth, Richard G. Newell and Karen Palmer, 2004, *Retrospective Examination of Demand-side Energy Efficiency Policies,* Resources for the Future, September.

Gillingham, Kenneth, Richard G. Newell, and Karen Palmer, 2009, *Energy Efficiency Economics and Policy,* Resources for the Future, April.

Go 60 MPG, *Delivering the Goods: Saving Oil and Cutting Pollution from Heavy Duty Trucks.*

Gold, Rachel, et al., 2011, *Appliance and Equipment Efficiency Standards: A Money Maker and Job Creator,* American Council for an Energy Efficient Economy, January.

Gold, Rachel, Laura, et. al., 2009, *Energy Efficiency in the American Clean Energy and Security Act of 2009: Impact of Current Provisions and Opportunities to Enhance the Legislation*, American Council for an Energy Efficient Economy, September.

Goldstein, David, Sierra Martines and Robin Roy, *Are there Rebound Effects from Energy Efficiency? An Empirical Analysis, Internal Consistency and Solutions,* Electric Policy.com.

Golove, William H. and Joseph H. Eto, 1996, *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency,* Lawrence Berkeley Laboratory.

Grayer, Ted and W. Kip Viscusi, 2012, *Overriding Consumer Preferences with Energy Regulation,* Mercatus Center, July.

Greene, David L., John German and Mark A. Delucchi, 2009, "Fuel Economy: The Case for Market Failure, in Daniel Sperling and James S. Cannon (Eds.), *Reducing Climate Impacts in the Transportation Sector,* Springer.

Greene, David, 2010, *Why the Market for New Passenger Cars Generally Undervalues Fuel Economy,"* OECD Joint Transport Research Centre, January.

Greene, David, 2011, "Uncertainty, Loss Aversion, and Markets for Efficiency," *Energy Economics,* 11.

Greene, David L. 2012, *How Consumers Value Fuel Economy: A Literature Review,* Oak Ridge National Laboratory, March.

Grimaudi, André and Gilles Laffrougue, 2008, *Climate Change Mitigation Policies: Are R&D Subsidies Preferable to a Carbon Tax,* Tolouse School of Economics, November 21.

Gross, Robert, et al., 2012, *On Picking Winners: The Need for Targeted Support for Renewable Energy,* Imperial College London, October.

Gross, Robert, William Blyth and Philip Heponstall, 2010, "Risks, Revenues and Investment in Electricity Generation: why Policy Needs to Look Beyond Costs," *Energy Economics,* 32.

Grubb, Michael, Thierry Chapuis and Minh Ha Duong, 1995, *The Economics of Changing Course: Implications of Adaptability and Inertia for Optimal Climate Policy.*

Hamilton, James D., 2009, "Causes and Consequences of the Oil Shock of 2007-2008," *Brookings Papers on Economic Activity,* Spring.

Hamilton, James D., 2012, *Oil Prices, Exhaustible Resources, and Economic Growth,* UC Center for Energy and Environmental Economics, February.

Harrington, Winston, 2006, *Grading Estimates of the Benefits and Costs of Federal Regulation: A Review of Reviews,* Resources for the Future, September.

Harrington, Winston, Richard Morgenstern and Peter Nelson, 2000, "On the Accuracy of Regulatory Cost Estimates," *Journal of Policy Analysis and Management* 19(2).

Harrington, Winston, Richard Morganstern and Peter Nelson, 2010, *How Accurate are Regulatory cost Estimates* (Resources for the Future.

Harmeling, Mirjam, Lara Nilsson, and Robert Harmsen, 2008, "Theory-based Policy Evaluation of 20 Energy Efficiency Instruments," *Energy Efficiency,* 1.

Hastie, R. 2001, "Problems for Judgment and Decision Making," *Annual Review of Psychology,* 52.

Hayes, Sara, Naomi Baum and Garrett Herndon, 2013, *Energy Efficiency: Is the United States Improving,* American Council For An Energy Efficient Economy, July.

Hepasli, A. and N. Azlap, 2003, "Development of Energy Efficiency and Management Implementation in the Turkish Industrial Sector," *Energy Conversion and Management, 44(2)*

Hertwig, Ralph and Stefan M. Herzog, 2009, "Fast and Frugal Heuristics: Tools of Social Rationality, *Social Cognition,* s7.

Hofrage, u. and T. Reimer, 2004, "Models of Bounded Rationality: The approach of Fast and Frugal Heuristics," *Management Review,* 15(4).

Homes, Ingrid and Rohan Mohanty, 2012, *The Macroeconomic Benefits of Energy Efficiency,* E3G.

Hopper, Nicole, et al., 2008, *Energy Efficiency as a Preferred Resource: Evidence From Utility Resource Plans in the Western United States and Canada,* Lawrence Berkeley National Laboratory, September.

Horbach, Jon, 2008, "Determinants of Environmental Innovations -- New Evidence from German Panel Data Source," *Research Policy*, 37.

Horksy, Dan, 1990, "A Diffusion Model Incorporating Product Benefits, Price, Income and Information," *Management Science,* 9:4.

Hosain, Tanjim and John Morgan, 2006, *Shrouded Attributes and Information Suppression: Evidence from Field Experiments,* Competition Policy Center, UC Berkeley, September.

Howarth, Richard B. and Alan H. Sanstad, 2007, "Discount Rates and Energy Efficiency," *Contemporary Economic Policy,* 13.

Howland, Jamie, Derek Murrow, Lisa Petraglie and Tyler Comings, 2009, *Energy Efficiency: Engine of Economic Growth,* ENE, October.

Hultik, Erik Jan, et al., 2000, "Launch Decision and New Product Success: An Empirical Comparison of Consumer and Industrial Products," *Journal of Product Innovation Management,* 17.

Hwang, Roland and Matt Peak, 2006, *Innovation and Regulation in the Automobiles Sector: Lessons Learned and Implicit on for California CO_2 Standards,* April.

International Energy Agency, 2007, *Minding the Gap: Quantifying Principal-Agent Problems in Energy Efficiency.*

Ito, Koichiro, 2011, *Do Consumers Respond to Marginal or Average Price?,* Energy Institute at Haas.

Jaffe, Adam B. and Robert N. Stavins, 1994, "The Energy Paradox and the Diffusion of Conservation Technology," *Resource and Energy Economics,* 16:2.

Jaffe, Adam B. and Robert N. Stavins, 1994, "The Energy-Efficiency Gap," *Energy Policy,* 22:10.

Jamasb, Tooraj, and Jonathan Kohler, 2007, *Learning Curves for Energy Technology: A Critical Assessment,* University of Cambridge, October.

Jessoe, Katrina and David Rapson, 2013, *Knowledge is (Less) Power: Experimental Evidence from Residential Energy Use,* February 19.

Johnstone, Nick and Ivan Hascic, 2010, *Directing Technological Change while Reducing the Risk of (not) Picking Winners: The Case of Renewable Energy,* November.

Johnstone, Nick, Ivan Hascic and David Popp, 2008, *Renewable Energy Policies and Technological Innovation: Evidence Based on Patent Counts,* National Bureau of Economic Research, January.

Jouvet, Pierre-Andre, Elodie Le Cadre and Caroline Orset, 2012, "Irreversible Investment, Uncertainty, and Ambiguity: The Case of Bioenergy Sector," *Energy Economics,* 34.

Junginger, Martin, et al., 2008, *Technological Learning in the Energy Sector,* Universities Utrach and Energy Research Centre of the Netherlands, April.

Kablan, N., 2003, "Energy Conservation Projects Implementation in Jordan's Industrial Sector:A Total Quality Management Approach," *Energy,* 28(15)

Kahouli Brahmi, Sondes, 2008, "Technological Learning in Energy-Environment-Economy Modeling: A Survey," *Energy Policy,* 36.

Kalkuhl, Matthias, Ottmar Edenhofer and Kai Lessmann, 2012, "Learning or Lock-in: Optimal Technology Policies to Support Mitigation, *Resource and Energy Economics,* 34.

Kemp, Rene and Serena Pontoglio, 2011, "The Innovation Effects of Environmental Policy Instruments -- A Typical Case of the Blind Men and the Elephant?," *Ecological Economics,* 72.

Kempton, Willett ,Craig K. Harris, Joanne G. Keith, Jeffrey S. Weihl, 1985, "Do Consumers Know What Works in Energy Conservation?," *Marriage & Family Review,* 9(1-2).

Kindel., Adrienne, Margaret Sheridan and Patrick McAulife, 2008, *A Comparison of Percept Electricity Consumption in the United States and California,* CEC Staff Paper, August.

Kiso, Takashiko, 2009, *Environmental Policy and Induced Innovation: Evidence from Automobile Fuel Economy Regulation.*

Kobos, Peter, H, Jon D. Erickson and Thomas E. Drennen, 2006, "Technological Learning and Renewable Energy Costs: Implications for US Renewable Energy Policy," *Energy Policy,* 34.

Koeppel, Sonja, Diana Urge-Vorsatz and Veronika Czako, 2007, *Evaluating Policy Instruments for Reducing Greenhouse Gas Emissions from Buildings – Developed and Developing Countries,* Assessment of Policy Instruments for Reducing Greenhouse Gas Emission from Buildings, Center for Climate Change and Sustainable Energy, Central European University.

Kohli, Rajeev, Donald R. Lehman and Jae Pae, 1999, "Extent and Impact of Incubation Time in New Product Diffusion, *Journal of Product Innovation Management,* 16.

Kok, Nils, Marquise McGraw and John M. Quigley, 2011, "The Diffusion of Energy Efficiency in Buildings," *Annual Meeting of the American Economic Association,* Denver.

Kopp, Raymond J. and William A Pfizer, 2007, *Assessing U.S. Climate Policy Options,* Resources for the Future, December.

Kuok, On, 2006, *Environmental Innovation Dynamics in the Automotive Industry:* Project Assessing Innovation Dynamics Induced by Environmental Policy. November 3.

Kurani, Kenneth S. and Thomas S. Turrentine, 2004, *Automobile Buyer Decisions about Fuel Economy and Fuel Efficiency Final Report to United States Department of Energy and Energy Foundation,* Institute of Transportation Studies University of California, September 2004.

Laitner, John A. and Alan H. Sanstad, 2004, *Learning-by-Doing on both the Demand and the Supply Sides: Implications of Electric Utility Investments in a Heuristic Model, International Journal of Energy Technology and Policy*.

Lattin, James M. and John H. Roberts, *Modeling the Role of Risk-Adjusted Utility in the Diffusion of Innovation.*

Leonhardt, David, 2012, "There's Still Hope for the Planet," *New York Times,* July 21.

Levinson, Arik, 2013, *California Energy Efficiency: Lessons for the Rest of the World, or Not?,* NBER, July 29.

Li, Jia, N.D. , *Modeling Household Energy Consumption and Adoption of Energy-Efficiency Technology Using Recent Micro-Data,"* Environmental Protection Agency.

Li, Shanjun, Christopher Timmins, and Roger von Haefen, 2009, "How do Gasoline Prices Affect Fleet Fuel Economy?", *American Economic Journal: Economic Policy,* 1(2).

Lindman, Asa and Patrik Soderholm, 2012, "Wind Power Learning Rates: a Conceptual Review and Meta-Analysis," *Energy Economics,* 34.

Linn, M and P. Murto, 2006, "Energy Prices and Adoption of Energy Savings Technology," *The Economic Journal,* 118.

Lutzenhiser, Loren, et al., 2005, *Market Structure and Energy Efficiency: The Case of New Commercial Buildings,* California Institute For Energy Efficiency.

Mahajan, Vijay, Eitan Muller and Frank M. Bass, 1990, "New Product Diffusion Models in Marketing: A Review and Directions of Research," *Journal of Marketing,* 54.

Massetti, Emanuele and Lea Nicita, 2010, *The Optimal Climate Policy Portfolio,* CESifo Working Paper Energy and Climate Economics, 2988.

Maurer, Joanna, et al., 2013, *Better Appliances: An Analysis of Performance, Features and Price as Efficiency is Improved,* Appliance Awareness Project, May.

McKinsey and Company, 2009, *Unlocking Energy Efficiency in the U.S. Economy,* July.

McKinsey and Company, 2010, *Energy Efficiency: A Compelling Global Resource.*

Meyers, Stephen, James McMahon and Michael McNeil, 2005, *Realized and Prospective Impacts of U.S. Energy Efficiency Standards for Residential Appliances: 2004 Update.*

Meyers, Stephen, James McMahon, and Barbara Atkinson, 2008, *Realizes and Projected Impacts of U.S. Energy Efficiency Standards for Residential and Commercial Appliances,* Lawrence Berkeley Laboratory, March.

Michalei, Itay, 2009, *CAFE and the U.S. Auto Industry Revisited,* CITI, October 13.999

Milstein, Irena and Sher Tishler, 2012, "The Inevitability of Capacity Underinvestment in Competitive Electricity Markets," *Energy Economics,* 2012: 34.

MIT, Laboratory of Energy and the Environment, 2008, *On the Road in 2035: Reducing Transportation's Petroleum Consumption and GHG Emissions,* July.

Montavelo, Carlos, 2008, "General Wisdom Concerning the Factors Affecting the Adoption of Cleaner Technologies: A Survey 1990-2007," *Journal of Cleaner Production.*

Nadel, Steven and Therese Langer, 2012, *Comments on "Is there an Energy Efficiency Gap?",* American Council For An Energy Efficient Economy, July.

Nadel, Steven, 2012, *The Rebound Effect: Large or Small,* American Council For An Energy Efficient Economy, August.

Nadel, Steve and Andrew Delaski, 2013, *Appliance Standards: Comparing Predicted and Observed Prices,* July.

U.S. National Highway Traffic Safety Administration, 2011, *Corporate Average Fuel Economy for MY2012-MY 2016 Passenger Cars and Light Trucks*, *Preliminary Regulatory Impact Analysis*.

National Research Council of the National Academies, 2009, America's *Energy Future: Technology and Transformation, Summary Edition.*

National Research Council of the National Academy of Science, *America's Energy Future,* 2009.

New York State Energy Research & Development Authority, 201, *Macro-economic Impact Analysis of New York's Energy Efficiency Programs: Using REMI Software,* August 4.

Nicolli, Francesco and Francesco Vona, 2012, *The Evolution of Renewable Energy Policy in OECD Countries: Aggregate Indicators and Determinants,* ofce.sciences-po, Working Paper, 2012-13.

Noailly, Joelle, 2012, "Improving Energy Efficiency of Building: The Impact of Environmental Policy on Technological Innovation," *Energy Economics,* 34.

Nordhaus, Ted, Michael Shellenberger and Alex Trembath, 2012, "Carbon Taxes and Energy Subsidies: A Comparison of the Incentives and Costs of Zero-Carbon Deployment, *Breakthrough Institute,* September 12

Nordhaus, William, 2011, "Designing a Friendly Space for Technological Change to Slow Global Warming," *Energy Economics,* 33

Northeast States Center for a Clear Air Future, International Council on Clean Transportation and Southwest Research Institute, 2009, *Reducing Heavy Duty Long Haul Combination Truck Fuel Consumption and CO_2 Emissions,* October.

Office of Regulatory Analysis and Evaluation National Center for Statistics and Analysis, 2011, *Preliminary Regulatory Impact Analysis Corporate Average Fuel Economy for MY 2017-MY 2025, Passenger Cars and Light Trucks,* November 2011.

Oh, Wankeun and Kihoon Lee, 2004, "Energy Consumption and Economic Growth in Korea: Testing the Causality Relation," *Journal of Policy Modeling,* 26.

Osawa, Yshitaka and Kumiko Miazaki, 2006, "An Empirical Analysis of the Valley of Death: Large Scale R&D Project Performance in a Japanese Diversified Company," *Asian Journal of Technology Innovation.*

Ozaki, R., and Sevastyanova, K., 2011. "Going Hybrid: An Analysis Of Consumer Purchase Motivations," *Energy Policy* 39.

Pielke, Roger, 2010, *EU Decarbonization 1980 to 2010 and Non-Carbon Forcings, Updating The Climate Fix,* rogerpielkejr.blogspot.com/2012/01/eu-decarbonization-1980-to-2010-and-non.html

Piscitello, Lucia, Paola Garrone and Yan Wang, 2012, *Cross Country Spillovers in the Renewable Energy Sector,* Druid Society, CBS, Copenhagen, June.

Poortinga, W., et al., 2003, "Household Preferences for Energy-Saving Measures: A Conjoint analysis," *Journal of Economic Psychology,* 24.

Popp, David, Richard g. Newell and Adam B. Jaffee, 2010, "Energy, the Environment, and Technological Change," in Bronwyn H. Halland and Nathan Rosenberg (Eds.), *Economics of Innovation* Burlington: Academic Press.

Qui, Yeuming and Laura D. Anadon, 2012, "The Price of Wind in China During its Expansion: Technology Adoption, Learning-by-doing, Economies of Scale, and Manufacturing Localization," *Energy Economics,* 34.

Requate, Till, 2005, "Dynamic Incentives by Environmental Policy Instruments," *Ecological Economics*, 54.

Reuter, et. al., 2012, "Renewable Energy Investment: Policy and Market Impacts," *Applied Energy,* 92.

Roland-Holst, David, 2008, *Energy Efficiency, Innovation, and Job Creation in California,* Center for Energy, Resources, and Economic Sustainability, October.

Rubbeike, Dirk and Pia Weiss, 2011, *Environmental Regulations, Market Structure and Technological Progress in Renewable Energy Technology – A Panel Data Study on Wind Turbines,* Fonazione Eni Enrico Mattei,

Ryan, Lisa and Nina Campbell, 2012, *Spreading the Net: The Multiple Benefits of Energy Efficiency Improvements,* International Energy Agency, Insight Series.

Sardianou, E., 2007, "Barriers to Industrial Energy Efficiency Investment in Greece," *Journal of Cleaner Production, 16.*

Sallee, James M., 2012, Rational *Inattention and Energy Efficiency,* NBER, September, 13.

Sanstad, Alan H. and Richard B. Howarth, 1994, "'Normal Markets, Market Imperfections and Energy Efficiency," *Energy Policy,* 22:10.

Sanstad, Alan H., W. Michael Haneman, and Maximillion Auffhammer, 2006, "End-Use Energy Efficiency in a "Post-Carbon California Economy," in *Managing Greenhouse Gas Emissions in California.* The California Climate Change Center at UC Berkeley.

Sarkar, Jayati, 1998 "Technological Diffusion: Alternative Theories and Historical Evidence, *Journal of Economic Surveys,* 2: 1998

Sathaye, Jayant and Scott Murtishaw, 2004, *Market Failures, Consumer Preferences, and Transaction Costs in Energy Efficiency Purchase Decisions,* California Energy Commission, November, consultant report.

Sathye, Jayant and Amol Phadke, 2011, "Energy Efficiency Cost Cures: Empirical Insights for Energy-Climate Modeling," in K. John Homers (Ed.) *Modeling the Economics of Greenhouse Gas Mitigation,* Washington, D.C.: National Academy Press, 2011.

Schleich, Joachim and Edelgard Gruber, 2008, "Beyond Case Studies: Barriers to Energy Efficiency in Commerce and the Service e Sector," *Energy Economics 30.*

Sood, Ashish, et al., 2012, "Predicting the Path of Technological Innovation: SAW vs. Moore, Bass, Gompertz and Jryder," Marketing *Science,* 31: 6.

Sorrell, Steve, Alexandra Mallett & Sheridan Nye. 2011, *Barriers to Industrial Energy Efficiency, A Literature Review,* United Nations Industrial Development Organization, Vienna.

Sperling, Dan et al., 2004, *Analysis of Auto Industry and Consumer Responses to Regulation and Technological Change and Customization of Consumer Response Models in Support of AB 1493 Rulemaking,* Institute of Transportation Studies, UC Davis, June 1.

Stern, Paul C., 2000, "Towards a Coherent Theory of Environmentally Significant Behavior, *Journal of Social Issues,* 56.

Sudarhsan, Anant, 2008, *Deconstructing the "Rosenfeld Curve,* Stanford.

Sullivan, Michael J. 2009, *Behavioral Assumptions Underlying Energy Efficiency Programs for Businesses,* California Institute for energy and Environment, January.

Sunderkotter, Malte and Christopher Weber, 2012, "Valuing Fuel Diversification in Power Generation Capacity Planning," *Energy Economics,* 34.

Sutherland, Ronald J., 2003, "The High Cost of Federal Energy Efficiency Standards for Residential Appliances," *Policy Analysis,* December 23.

Szolgayova, et al., 2012, "Robust Energy Portfolios Under Climate Policy and Socioeconomic Uncertainty," *Environmental Model Assessment,* 17.

Takahashi, Kenji and David, Nichols, 2008, *The Sustainability and Cost of Increasing Efficiency Impacts: Evidence from Experience to Date,* American Council For An Energy Efficient Economy, Summer Study on energy Efficient Buildings.

Taylor, Lester, 1998, *Economics,* Houghton Mifflin.

Taylor, Margaret, 2012, "Innovation Under Cap-and-Trade Programs, *PNAS Early Edition*.

Taylor, Margaret, Edward S. Rubin and Gregory F. Nemet, 2006, "The Role of Technological Innovation in Meeting California's Greenhouse Gas Emission Targets," in W. Michael Hanemann and Alexander E. Farrell (Eds.) *Managing Greenhouse Gas Emissions in California,* The California Climate Change Center at UC Berkeley, January.

Taylor, Margaret, et al., 2012, *An Exploration of Innovation and Efficiency in an Appliance Industry,* Lawrence Berkeley National Laboratory.

Temperton, Ian, 2012, "Dining Out on Electricity Market Reform with Kylie, the Tooth Fairy and a Spherical Horse in a Vacuum," *Climate Change Capital.*

Thollander, P., J. Palm, P. Rohdin, 2010, *Categorizing Barriers to Energy Efficiency – an Interdisciplinary Perspective,* InTech Publisher.

Toke, David, Sylvia Breukers and Maarten Wolsnik, 2008, "Wind Power Deployment Outcomes: How can we Account for the Differences?," *Renewable and Sustainable Energy Review,* 12.

Turrentine, Thomas S. and Kenneth S. Kurani, 2007, "Car Buyers and Fuel Economy?" *Energy Policy,* 35.

U.S. Department of Energy, 2013, *Energy Efficiency Design Standards for New Federal Commercial and Multi-Family High-Rise Residential Buildings,* Federal Register, July 9.

U.S. Energy Information Administration, *State Electricity Database.*

U.S. Energy Information Administration, 2010, *Memorandum: Economy-wide Impacts of Greenhouse Gas Tailpipe Standards,* Docekt No. EPA-HQ-QAR-2009-0472, March 4.

U.S. Environmental Protection Agency and Department of Transportation, "Greenhouse Gas Emission Standards and Fuel Efficiency Standards for Medium and Heavy Duty Truck," *Federal Register,* 76:179.

U.S. Environmental Protection Agency and Department of Transportation, 2011, *In the Matter of Notice of Upcoming Joint Rulemaking to Establish 2017 and Later Model Year Light Duty Vehicle GHG Emissions and CAFE Standards,* Docket ID No. EPA-HQ-OAR-0799 Docket ID No. NHTSA-2010-0131.

Uihlein, Andreas and Peter Eder, 2009, *Toward Additional Policies to Improve the Environmental Performance of Buildings,* European Commission, Joint Research Centre, Institute for Prospective Technological Studies.

Ulrich Hoffrage and Torsten Reimer, 2004, Models of Bounded Rationality: The Approach of Fast and Frugal Heuristics, *Management Revue*, 15(4).

Vine, Edward, 2009, *Behavior Assumptions Underlying Energy Efficiency Programs For Businesses,* California Institute for Energy and Environment, January.

Walz, R., 2007, "The Role of Regulation for Sustainable Infrastructure Innovation: the Case of Wind Energy," *International Journal of Public Policy.*

Walz, R., J. Schleich and M. Ragwitz, 2007, "Regulation, Innovation and Wind Power Technologies – An Empirical Analysis for OECD Countries, *DIME Final Conference,* Maastricht, April 2011.

Warr, Benjamin S, Robert U. Ayers and Eric Williams, 2009, *Increase Supplies, Increase Efficiency: Evidence of Causality Between the Quantity and Quality of Energy Consumption and Economic Growth,* INSEAD.

Wie, Max Shana Patadia and Daniel Kammen, 2010, "Putting Renewables and Energy Efficiency to work: How Many Jobs Can the Clean energy Industry Generate in the US?", *Energy Policy,* 38.

Weiss, et al., 2010, "Analyzing Price and Efficiency Dynamics of Large Appliances with the Experience Curve Approach," *Energy Policy,* 38.

Weyant, John P., 2011, "Accelerating the Development and Diffusion of New Energy Technologies: Beyond the Valley of Death," *Energy Economics*, 33.

Whitefoot, Kate, Meredith Fowler and Steven Skerlos, 2012, *Product Design Response to Industrial Policy: Evaluating Fuel Economy Standards Using an Engineering Model of Endogenous Product Design,* Energy Institute at Haas, May.

Wilkinson, Nick, 2008, *An Introduction to Behavioral Economics,* New York: Palgrave.

Wilson, Charlie and Hadi Dowlatabadi, 2007, "Models of Decision Making and Residential Energy Use," *Annual Review of Environmental Resources,* 32.

Wilson, Charlie, et al., 2012, "Marginalization of End Use Technologies in Energy Innovation for Climate Protection, *Nature Climate Change,* 2.

Woolf, Tim, Vladlena Sabadosh and Bruce Biewald, 2011, *Equipment Price forecasting in Energy Conservation Standards Analysis,* Synapse, March 24.

Worrel, Ernst, et al., 2003, "Productivity Benefits of Industrial Energy Efficiency measures," *Energy,,* 28(11)..

Young, Rachel, R. Neal Elliot and Martin Sushler, 2012, *Saving Money and Reducing Risk: How energy Efficiency Enhances the Benefits of the Natural Gas Boom,* American Council For An Energy Efficient Economy, September.

Zihali, G., 2004, "Organizationsal Factors Determining the Implementation of Clean Production in the Corporate Sector," *Journal of Cleaner Production,* 12(4).

Zorlu, Pelin, et al., 2012, *Risk Managing Power Sector Decarbonization in the UK,* E3G, October.

WHY GROWING UP IS HARD TO DO: INSTITUTIONAL CHALLENGES FOR INTERNET GOVERNANCE IN THE "QUARTER-LIFE CRISIS" OF THE DIGITAL REVOLUTION

MARK COOPER*

VI: GOVERNANCE INSTITUTIONS FOR THE DIGITAL REVOLUTION

A. Principles for Adaptation of Internet Governance

The combination of the weakness of the competing institutions (the market and the state) and the success of the Internet resource system suggests that enhancing the polycentric institution between the market and the state remains a viable, preferable approach to respond to the challenges. But, it is also clear that the existing institutions must adapt to meet the challenges. This section offers a series of principles for adapting Internet governances to the maturation challenges derived from the conceptual and empirical framework described earlier. It lays the foundation for the argument in the next section that "participatory governance" is a critically important institutional innovation needed to preserve and extend the success of the Internet resource system. It locates the concept in relation to the Internet governance debate, the broader crisis of legitimacy of the state, and the ongoing debate over regulatory reform.

1. Priorities for Preserving the Internet Principles by Expanding the Space of Governance Between Market and State

Meeting the challenge of "how we shift from 'government to governance' . . . relat[ing] traditional steering activities . . . with broader coordination tasks that . . . combine the multiple perspectives and needs of all institutional and noninstitutional Internet users"[1] requires an approach that

- recognizes the state will almost certainly be the origin of the fundamental steering choices, but
- ensures that it sets a course that preserves the Internet principles, while expanding the scope of autonomy between the market and the state.

I have argued that this was exactly the effect of the late 1960s Carterphone and Computer Inquiry proceedings and the decision to "unlicensed" some spectrum, so this is not an impossible task. Moreover, the understanding that this is the essential challenge permeates the Internet governance debate. The International documents discussed in Section III recognize the balance that must be struck between policy goals and the preservation of the dynamic Internet resource system. Table VI-1 adds to this body of evidence in a somewhat different way. It summarizes four analyses from the 2004-2005 period, which was a high point in the international debate over Interne governance because of the approach of the World Summit on the Information Society meeting in Tunis.[2] These are fairly comprehensive discussions that included explicit recommendations. They can be summarized in a small number of principles to guide the adaptation of the Internet governance substantive policymaking effort.

Structure and Units

1. To the greatest extent possible, preserve the end-to-end principle based on open, non-proprietary standards.
2. Recognize that markets have played a central role in deploying infrastructure and developing applications to drive Internet success, but

* *Journal on Telecommunications and High Technology Law*, 11:1 (2013).

1. PAVAN, *supra* note 19, at xxix.

2. *See World Summit on the Information Society*, WIKIPEDIA, http://en.wikipedia.org/wiki/World_Summit_on_the_Information_Society (last modified Aug. 18, 2012, 10:54 PM).

3. policy must also recognize that (a) the threats of scarcity and the exercise of market power require vigilant attention; (b) the political goal of the flow of information is not always synonymous with private or governmental interests; and (c) the social goal of universal service is not guaranteed by markets.

Users and Uses

4. Protect free flow of information, recognizing that both good and bad information may flow freely and states or private corporations are not always the best arbiters of which is which.
5. Promote the universal deployment of resources for development and the widest possible array of uses, which are the fundamental measure of success of the resource system.

Management and Governance

6. Apply a broad subsidiarity principle to policy, which means, in general, tasking institutions with responsibilities for which they are well-suited and, in particular, not burdening technical standards with socio-ecological policy responsibilities to the greatest extent possible.
7. Strengthen polycentric, inclusive, multi-stakeholder governance institutions.

MATURATION CHALLENGES[3]

2. The Multi-stakeholder Approach to Governance

a. Support for Multi-stakeholder Approaches in the Internet Space

One area where there has been considerable consensus at a high level of generalization in the Internet governance debate involves the institutional process for policymaking. For most of the issues raised, it is generally accepted that adaptation should flow from the existing institutions that have relied on multi-stakeholder principles. Where multi-stakeholder institutions are absent, they should be created. The observations on governance process of the three international groups identified in Section III are summarized in the top part of Table VI-2. The goals of participation, transparency, fairness, and data-based decision-making are endorsed with few countervailing concerns. Thus the conception of how multi-stakeholder processes should work is universally supported.

The bottom part of Table VI-2 reflects the magnitude of the challenge in another way. It shows the four sets of Internet stakeholders identified by the WGIG document. Each of the stakeholder groups corresponds fairly closely to one of the realms of social order. Moreover, the four sets of stakeholders have a great deal to do. The essential challenge for the multi-stakeholder process is to get the many different sets of stakeholders to collaborate to ensure that they all fulfill their long list of responsibilities.

3. Petru Dumitriu, *The World Summit on the Information Society (WSIS): From Geneva (2003) to Tunis (2005). A Diplomatic Perspective*, *in* MULTISTAKEHOLDER DIPLOMACY, CHALLENGES & OPPORTUNITIES 33 (Jovan Kurbalija & Valentin Katrandijev eds., 2006); Milton Mueller, John Mathiason & Lee W. McKnight, *Making Sense of "Internet Governance": Defining Principles and Norms in Policy Context*, *in* INTERNET GOVERNANCE: A GRAND COLLABORATION 100 (Don MacLean ed., 2004); William J. Drake, *Reframing Internet Governance Discourse: Fifteen Baseline Propositions*, *in* INTERNET GOVERNANCE: A GRAND COLLABORATION 122 (Don MacLean ed., 2004); *UNCTAD*, *supra* note 51.

Key to Sources: Petru Dumitriu, "The World Summit on the Information Society (WSIS): From Geneva (2003) to Tunis (2005). A Diplomatic Perspective, "**in** J. Kubalija and V. Katundjun (Eds.) Multistakeholder Diplomacy, Challengers & Opportunities (2006); **Milton Mueller, John Mathiason and Lee W. McKnight, "Making Sense of 'Internet Governance': Defining Principles and Norms in Policy Context in Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004);** *William Drake, Reframing Internet Governance Discourse: Fifteen Baseline Propositions, In Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004);* United Nations Conference on Trade and Development (UNCTAD), "Internet Governance," in Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004).

PRINCIPLES	PURPOSES
Structure & Units	
The global commons	**The Internet is based on global open, and non-proprietary standards. They are published and accessible to anyone without payment of fees.**

POLICY RECOMMENDATIONS: We need to keep those doors open. Nevertheless, maximum caution is necessary when attempting to privatize essential commons. **Do not allow the commons to be privatized.**

End-to-End Principle	**Architectural principle creates an interoperable, neutral, transparent platform supporting a wide variety of applications and services**

POLICY RECOMMENDATIONS: Preserve the technical standard Management of resources should not be overloaded with policy… Resource allocation should be consistent with the end - to-end principle… Regulation of the fraudulent and criminal activity must be directed at responsible endpoints, not at the internetworking process itself. In all these cases, the substantive character of the issue at hand, rather than the fact that the Internet is the medium through which the problematic activity is conducted, should be the determining criterion as to what level of "governance" (from consensus building and cooperation to rule-making) and what instruments should be applied.

Inclusiveness	**The Internet has been driven "from the bottom up"**

POLICY RECOMMENDATIONS: This feature could be enhanced by consolidating or by building from scratch governance structures that are genuinely open and inclusive of governments. *The effective inclusion of developing countries requires much greater attention…. Greater attention is needed to the inclusion of civil society organizations, small and medium-sized enterprises and individual users.* First, it must be recognized that whatever the merits of the case for their reform, the loose constellation of organizations that have so far underpinned the development of the Internet have achieved remarkable success in ensuring the stability and unit of a highly decentralized network of networks with no centre and not strong rule-making authority… In order for any reform proposal to be viable, not just technically but also politically, it must provide strong evidence that it will ensure the continued stability and quality of service of the Internet, prevent its fragmentation and maintain the "bottom-Up" processes through which standards and policies have been developed so far. *Technical and policy issues often cannot be neatly separated*

Private Market	**Fosters decentralized, small scale investment and variation in approach**

POLICY RECOMMENDATIONS: Do not transform standards commons into a basis for regulating the private market. *With respect to the substance of rule systems, efficiency means devising frameworks that do not inhibit technological change, unduly constrain the development of markets, or make it difficult for governments and stakeholder to reach agreements.* No one size fits all solutions are likely to emerge… a number of questions in which technological and policy issues are particularly intertwined are likely to be best treated within a network of international frameworks (as opposed to a unified, structured organization) of cooperation and coordination for the development of the Internet… In such a cooperative framework flexibility should be a paramount consideration… Structural flexibility and lightness are also needed in order to prevent governance solutions from being rendered obsolete by technological evolution.

Functionality/ and *Congruence*	**The Internet… development actually started from the need to perform a function.**

POLICY RECOMMENDATIONS: If we decide to use the Internet as a tool for achieving social development objectives, the governance model we follow should not be meant only to monitor, to restrict and to regulate. We need to allow and enhance functionality by representing and adequately using a balance of interests, capabilities and needs that exist in exist in real life. *Efficiency concerns suggest that form should follow function to the extent possible… In general terms, it is desirable to optimize institutional forms so that they match the issues to be managed. This overarching concern applies to both the substantive rules and institutional procedures in governance mechanisms.* [E]volution is more likely to produce results than a voluntarist top down approach. The current system of management of core Internet resources is the result of a process that has taken place over a remarkably short time. It is clear that this evolution has not yet reached a stage of maturity that is acceptable to all stakeholders. It must also complete a process of genuine internationalization (which is not necessarily equivalent to full-fledged intergovernmentalization, but which implies representatively requirements beyond the participation of individuals/organizations of various nationalities. In doing so it is essential to reconcile demands for change with the need to ensure continued delivery of the critical services.

Users and Uses

Moral Neutrality **Self-reliance**	**Transparency, speed and accessibility of information and content and services. But this communications enabling power applies to "bad ""as well as "good" information communications behavior.**

POLICY RECOMMENDATIONS: Private networks or users can build electronic "fences" or adopt filters or practices that can, to some extent, shelter themselves from undesirable forms of while maintaining some form of compatibility and interconnection with the rest of the world. Whereas and traditional notions of government and governance imply uniformity, Internet permits variation in policies adopted in response to the same problem.

Resource scarcity, Scale and dependence increase value of control concentration, & control

POLCY RECOMMENDATIONS: Concentration and control raise legitimate grounds to investigate bottlenecks and the economic and political impact of legacy control. *Equity concerns are equally important and will become more so as the Internet becomes increasingly pervasive and thus affects a wider range of social interests.... What about situations... where concentrated market structures allow powerful firms to in effect set generally applied rules via their business strategies, rather than through collaborative decision making?*

Internet for development Infrastructure development should be decentralized and competitive

POLICY RECOMMENDATIONS: In order to help governments reach their economic and social aims, one should not look for methods to control the Internet, but for means to use its comparative advantage and prevent ICTs from becoming a factor that broadens, Instead of narrows, divides… We need to turn the technological advances into economic and social benefits; to attach societal assets to technological virtues, and to explore potential that have been unchartered. **Digital divide subsidies, if there are to be any, should go to end users and not to centralized suppliers or governments. Providing resources to end users...to acquire those elements of end user infrastructure should serve to stimulate and encourage development while maintaining a maximum degree of choice and diversity in supply.**

Governance

Polycentric **Multi-stakeholder**	**Distributed and multifarious, cannot be regulated in a top down manner** *Internet governance involves a heterogeneous array of formalized public and private sector rules that vary widely in their institutional attributes. Entails a heterogeneous and highly distributed array of prescriptions and processes that reflects the Internet's core features rather than centralized "one size fits all" control over a single system.* Spontaneous expression of the consensus and discipline of the main players on the use of standards and protocols

POLICY RECOMMENDATIONS: Multistakeholder governance should be encouraged government, private business, civil society and international organizations. If we replace the naturally normative work that has been emerging spontaneously with more systematic work, we need a common understanding of what should be expected from the parties involved. After defining those contours of governance, we may gradually move toward agreement on rules, decision-making procedures, and institutions. *Viewing these governance mechanisms in an integrative manner would allow us to evaluate the full diversity of public and private sector practices that help to shape bot the infrastructure and transactions and content, to systematically assess what works... and to consider whether there are any holes, tensions or cross- cutting issues... [I]f properly structured, it could well build a stronger global consensus that would underpin the Internet's continuing growth as an open and vibrant medium.* <u>A sustained effort of capacity building for Internet policy making is needed so that the majority of the developing countries can effectively participate in the management/governance systems.</u>

Specialization	Inclusion does not rule out specialization as a prerequisite for efficiency and effectiveness.

POLICY RECOMMENDATIONS: Internet governance should count on specialization. The separate and complementary functions of public and private governance structures, the legitimate roles of different actors, and the need to create organic and as building blocks.

Self-restraint Accountability	The highly technical nature of the work on standards and protocols does not imply ignoring social consequences.

POLICY RECOMMENDATIONS: While accepting the need for more governance, it is equally important for public policy to refrain from regulating what does not need to be regulated. Normal democratic procedures... will inevitably be slow in an environment of rapid change and technological development. Governments should be knowledgeable about prospects in the technical field. The same conclusion is valid for national policies and laws of the powerful countries when they set rules that affect the global community. *If they are not designed to maximize efficiency and flexibility, they may not be functionally effective or politically sustainable.* <u>Of course, it is not possible to establish a clear-cut separation between all infrastructural/technical matters on the one side and political and socio-economic questions on the other. Policy decisions very often have technological implications and vice versa. A crude device to categorize public policy issue that need to be addressed and the responses that could be explored in each case could be to distinguish between the management of the Internet as a global utility and the international governance issues posed by the use people make of the utility.</u>

TABLE VI-1: FOUNDATIONS OF INTERNET SUCCESS AND RECOMMENDATIONS FOR RESPONDING TO THE

Purposes and Principles

Working Group on Policy Making	OECD Principles for Internet Governance	UNESCO Code of Ethics
Meaningful participation in global policy Multi-stakeholder forum to address Internet-related policy issues Functions: Audit, Arbitration, Coordination Regulation Structure: multilateral, transparent Ensure transparency, fair process, and accountability democratic inclusive: governments, private sector, civil society, Regional, national International coordination, International Orgs.	Encourage multi-stakeholder co- development operation in policy development processes: Foster voluntarily developed codes of conduct Develop capacities to bring publicly available, reliable, data into the policy-making process: Limit intermediary liability Give appropriate priority to enforcement efforts	Member states are responsible for ensuring an an inclusive, relevant, up-to-date and legal environment for the development of the information society

Sources: OECD, *Communiqué on Principles for Internet Policy-Making*, OECD High Level Meeting, The Internet Economy: Generating Innovation and Growth, Paris, June 28-29, 2011; *Report of the Working Group on Internet Governance*, Chateau de Bossey, June 2005.

Internet Stakeholder Groups and Responsibilities

Governments (Polity)

Public policymaking and coordination and implementation, as appropriate, at the national level, and policy development and coordination at the regional and international levels.
Creating an enabling environment for information and communication technology (ICT) development.
Oversight functions.
Development and adoption of laws, regulations and standards.
Treaty-making.
Development of best practices.
Fostering capacity-building in and through ICTs.
Promoting research and development of technologies and standards.
Promoting access to ICT services.
Combating cybercrime.
Fostering international and regional cooperation.
Promoting the development of infrastructure and ICT applications.
Addressing general developmental issues.
Promoting multilingualism and cultural diversity.
Dispute resolution and arbitration.

Civil society (Socio-cultural)

Awareness-raising and capacity-building (knowledge, training, skills sharing).
Promoting various public interest objectives.
Facilitating network-building.
Mobilizing citizens in democratic processes.
Bringing perspectives of marginalized groups, including, for example, excluded communities and grass-roots activists.
Engaging in policy processes.
Contributing expertise, skills, experience and knowledge in a range of ICT policy areas.
Contributing to policy processes and policies that are more bottom-up, people-centred and inclusive.
Research and development of technologies and standards.
Development and dissemination of best practices.
Helping to ensure that political and market forces are accountable to the needs of all members of society.
Encouraging social responsibility and good governance practice.
Advocating for the development of social projects and activities that are critical but may not be "fashionable" or profitable.
Contributing to shaping visions of human-centred information societies based on human rights, sustainable development, social justice and empowerment.

The private sector (Economy)

Industry self-regulation.
Development of best practices.
Development of policy proposals, guidelines and tools for policymakers and other stakeholders.
Research and development of technologies, standards and processes.
Contribution to the drafting of national law and participation in national and international policy development.
Fostering innovation.
Arbitration and dispute resolution.
Promoting capacity-building.

Academic/technical Community (Technology).

The contribution to the Internet of the academic community is very valuable and constitutes one of its main sources of inspiration, innovation and creativity.
Similarly, the technical community and its organizations are deeply involved in Internet operation, Internet standard-setting and Internet services development.
Both of these groups make a permanent and valuable contribution to the stability, security, functioning and evolution of the Internet. They interact extensively with and within all stakeholder groups.

Source: Report of the Working Group on Internet Governance, Chateau de Bossey, June 2005

TABLE VI-2: PRINCIPLES AND STAKEHOLDERS FOR INTERNET GOVERNANCE

b. Broader Challenges of Legitimacy

The interest in a multi-stakeholder approach is not only consistent with the organic Internet governance institution,[4] it also responds to the perceived decline in the legitimacy of the state. An EU White Paper from 2003 on parliamentary democracy notes the challenge of maintaining the connection between representative political institutions and the public as the information age progresses.

> Parliamentary territorial representation entails the involvement of a select few in law- and policy-making and provides a reliable basis for well-organized deliberation and decision-making. It enables in many cases more or less effective and reliable legislative action judged to be legitimate. Of course, such arrangements risk a de-coupling between Parliament and "the people." Two institutional arrangements were supposed to limit such de-coupling, namely regular parliamentary elections and a free press. But, as suggested in this [p]aper, much more is needed. Modern citizenry does not consist of a homogeneous mass public, or merely supporters of one or more parties. They are increasingly complex in their judgments and engagements. They make up an ensemble of publics and differentiated interests and competencies.[5]

Thus, the fundamental challenge in the economy of preserving a dynamic diverse product space in which consumers play a more active role has a direct parallel in the polity. A diverse, knowledgeable citizenry that wants to be and is engaged in the policy process challenges the incumbent institutions. It can be argued that the Internet is ahead of the polity in that it has provided a partial solution that took this

4. *See* Mueller, *supra* note 19, at 217 (calling them "Organically Developed Internet Institutions.").
5. T.R. Burns, *The Future of Parliamentary Democracy: Transition and Challenge in European Governance*, green paper for the *Conference of the Speakers of European Union Parliaments*, CAMERA DEI DEPUTATI (IT.)(Sept. 22-24, 2000). http://www.camera.it/_cppueg/ing/conferenza_odg_Conclusioni_gruppoesperti.asp.

direction, but it should also be recognized that the framework for promoting and channeling civil society engagement to build a legitimate and effective set of institutions is a work in progress.

The key to achieving the goal of enhancing democratization identified in the White Paper is that as the state recedes; it must use the remaining "legal connection" to promote participatory governance to ensure a larger direct role for the public. The principles of parliamentary reform offered as a response to this growing democratic deficit can be applied broadly to governance.

> [W]e suggest consideration of reforms of parliamentary functions, role, and institutional arrangements guided by principles such as the following:
>
> The principle of exercising high selectivity – with respect to the policy areas in which Parliament engages itself directly, for example in the formulation of specific or detailed laws and policies. This calls for explicit consideration of the reasons for such focused involvement.
>
> The principle to delegate whenever possible – a form of subsidiarity principle – to self-organizing policy sectors, at the same time holding accountable these sectors or key or powerful actors in these sectors. Part of this entails establishing effective monitoring and accounting arrangements.
>
> Institutionalizing these self-organizing policy sectors would serve also to legitimize the collective deliberations and decisions in these self-governing communities.
>
> The principle of focusing on strategic problems and issues that cannot be readily delegated or dealt with through private interests or civil society . . . .[6]

This is a road map for transferring active decision-making from the state to civil society. It is consistent with Ostrom's observations on the nesting of governance of resource systems in complex environments.

> Given the wide variety of ecological problems that individuals face at diverse scales, an important design principle is getting the boundaries of any one system roughly to fit the ecological boundaries of the problem it is designed to address. Since most ecological problems are nested from very small local ecologies to those of global proportions, following this principle requires a substantial investment in governance systems at multiple levels—each with some autonomy but each exposed to information, sanctioning, and actions from below and above.[7]

3. The Many Flavors of Alternative Governance

Reflecting the central theme of increasing direct participation in governance, Figure VI-1 arrays the various approaches to governance along two dimensions—the extent of state involvement and the extent of public involvement. I use the term "alternative governance" because a number of adjectives have been used to describe both the substance and process of regulatory change.[8] At the origin, the role of the industry is dominant. Along the X-axis the role of the state increases. Along the Y-axis the role of civil society increases.

---

6. *Id.* (bullet points removed).

7. OSTROM, *supra* note 31, at 258 (citations omitted).

8. Much of the argument for alternative regulation has its origin in the experience of environmental regulation, but the concept has spread to the information, communications and media sectors. *See* Neil Gunningham, *Compliance, Enforcement and Innovation*, ORG. ECON. CO-OPERATION & DEV. (2004), http://www.oecd.org/environment/environmentinemergingandtransitioneconomies/33947825.pdf; Neil Gunningham, *Regulatory Reform Beyond Command and Control*, AMSTERDAM CONF. ON THE HUM. DIMENSIONS GLOBAL ENVTL. CHANGE (May 26-27, 2007), http://www.2007amsterdamconference.org/Downloads/AC2007_Gunningham.pdf.

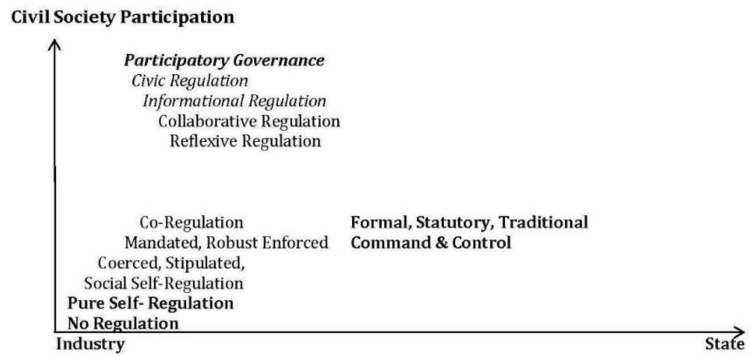


FIGURE VI-1: THE GROWING STOCK OF REGULATORY APPROACHES

Table VI-3 provides definitions for the various types of regulation that have been discussed in the literature. They are listed in order running from least to most regulatory, as I understand the thrust of the underlying concepts.

There are two polar opposites identified in this approach – "no regulation" is the least regulatory and traditional regulation the most. No regulation is the condition in which the transaction is not governed by direct involvement of the state or any explicit regulatory mechanism. Rather, the invisible hand of the market is presumed to ensure socially desirable outcomes.[9] At the opposite extreme, traditional, formal, statutory regulation occurs where the state (through its representative institutions) sets the goals and empowers the administrative apparatus of the state to write, implement, and enforce rules. Between the polar opposites, we have long had a number of mixed approaches and the number has been growing in the past two decades. Pure self-regulation occurs where the sellers in the market band together to produce rules to discipline the behavior of sellers in the market, presumably to promote the common interest of the sellers. In the case of pure self-regulation, sellers adopt the institution of regulation on a purely voluntary basis. The invisible hand pushes sellers into collective action.

The large number of self-regulatory approaches appears to be grounded in the recognition that there is an incentive and collective action problem with self-regulation. The concern about the inadequacy of self-regulation includes heterogeneity of the space that is being addressed. This leads to schemes that contemplate legislative mandates and the need for external monitoring and enforcement.

9. Of course the state plays a big role in creating the general conditions that make markets possible. *See* NORTH, *supra* note 15.

Alternative Types of Regulation

No regulation (Ofcom, 7)) Markets are able to deliver required outcomes. Citizens and consumers are empowered to take full advantage of the products and services and to avoid harm.

Self-regulation (Ofcom, 7) Industry collectively administers a solution to address citizen or consumer issues, or other regulatory objectives, without formal oversight from government or regulator. There are no explicit ex ante legal backstops in relation to rules agreed by the scheme (although general obligations may still apply to providers in this area).

Pure Self-regulation (EMR 23)
Stipulated Self-regulation (KLS 121)
Robust, Enforceable Self-regulation (FTC)
Enforced Self-regulation (EMR at 22)
Coerced Self-regulation (EMR at 16)
Mandated Self-regulation (R at 12)
Social Self-regulation (GA 9)

Co-Regulation (Ofcom, 7) Schemes that involve elements of statutory regulation, with public authorities and industry collectively administering a solution to an identified issue. The split of responsibilities may vary, but typically government or regulators have legal backstop powers to secure desired objectives. (EMR)

Collaborative Regulation (EMR 15) The role and structure of the state are fundamentally transformed in a changing society. Governance is seen as a process of interaction between different social and political actors, and growing interdependencies between the two groups, as modern societies become ever more complex, dynamic, and diverse.

Reflexive Regulation (W 2) an entire infrastructure aimed at establishing… the right incentives for those bearing the costs of regulation; the right participatory structure for shaping the instruments so that all those affected have a voice in shaping them; the guarantee of legal certainty; and the possibility to hold actors accountable for the consequence of particular actions (GA 4)

Civic Regulation (GA 7, 11) The goal of civil regulation is to fill the vacuum left by the contracting state and to compensate for the "deficit of democratic governance that we face as a result of economic globalization… Under civic regulation, the various manifestations of civil society act in a variety of ways to influence corporations, consumers and markets…From civil regulation perspective, the state's role is to provide mechanisms that will empower the institutions of civil society to make corporations more accountable.

Regulatory Pluralism ((GA at 10)
Informational Regulation (GA 7)

Participatory Governance (GA 7) various manifestations of civil society act in a variety of ways to influence corporations, consumers and markets, often bypassing the state… However, the evolving role of civil regulation has not taken place entirely divorced from state intervention… a number of next generation policy instruments are geared to empower various institutions of civil society to play a more effective role in shaping business behavior.

TRADITIONAL, COMMAND AND CONTROL REGULATION

Statutory Regulation (GA at 4) Objectives and rules of engagement are defined by legislation, government or regulator, including the processes and specific requirements on companies with enforcement carried out by public authorities.

Formal (Ofcom 7)
Statutory (Ofcom, 7)
Notice and Comment (Ofcom)
Command and Control (EMR at 12, GA 2)
State Regulation (EMR at 16)

Sources and key:

B	T.R . Burns, The Future of Parliamentary Democracy: Transition and Challenge in European Governance, Green Paper for the Conference of the Speakers of EU Parliaments, 22-24 September 2000, http://www.camera.it/_cppueg/ing/conferenza_odg_Conclusioni_gruppoesperti.asp
EMR	Hans Bredow Institute, Final Report: Study on Co-Regulation Measures in the Media Sector, University of Hamburg, June 2006http://ec.europa.eu/avpolicy/docs/library/studies/coregul/final_rep_en.pdf
GA	Neil Gunningham, Compliance, Enforcement and Innovation http://www.oecd.org/dataoecd/18/38/33947825.pdf
GB	Neil Gunningham, Regulatory Reform Beyond Command and Control, Earth System Governance: Theories and Strategies for Sustainability at the Amsterdam Conference on the Human Dimensions of Global Environmental Change, 24-26 May 2007http://www.2007amsterdamconference.org/Downloads/AC2007_Gunningham.pdf
H	Denis D. Hirsch, "The Law and Policy of Online Privacy: Regulation, Self-Regulation, or Co-Regulation, Theory Working Papers New York University School of Law http://lawpublications.seattleu.edu/cgi/viewcontent.cgi?article=2003&context=sulr
kln	Bert-Japp Koops, et al., Starting Point for ICT Regulation, B-J Koops, et. al (Eds.), Starting Points for ICT Regulation, ITER, The Hague, 2006http://rechten.uvt.nl/prints/upload/200662790842312037944.pdf
OfCom	Office of Communications, Identifying Appropriate Regulatory Solutions: Principles for Analysing Self- and Co-Regulation, 10-Dec-08http://stakeholders.ofcom.org.uk/consultations/coregulation/statement/
R	Ira S. Rubinsien, Privacy and Regulatory Innovation: Moving Beyond Voluntary Codes NELLCO Legal Scholarship Repositoryhttp://lsr.nellco.org/cgi/viewcontent.cgi?article=1181&context=nyu_plltwp
SLK	Laura Stein, et al., Civil Society, Participation in Multi-stakeholder Processes: in Between Realism and Utopia, LSE Research Online, 2009, http://eprints.lse.uk/27901
W	Sabine Weiland, Reflexive Governance — a Way Forward in Coordinated Natural Resource Policy?, REFGOV, Working paper series: REFGOV-GPS-19, draft versionhttp://refgov.cpdr.ucl.ac.be/?go=publications&cat=1&subcat=2

TABLE VI-3: DESCRIBING ALTERNATIVE TYPES OF REGULATION

Once the state becomes involved, we are no longer in the realm of pure self-regulation. However, these days the literature offers up a series of concepts of self-regulation in which it is no longer "voluntary," but still is free from state command and control. These include enforced, coerced, stipulated, mandated, and social self-regulation. In some of these cases, the threat of state regulation is seen as the factor that motivates sellers to implement "self-regulation" to avoid having regulation imposed by the state. In other cases, the state requires the industry to self-regulate, but does not take part in framing or implementing the regulatory scheme.

Co-regulation receives a great deal of attention when the options on the table move beyond self-regulation. Note that all of the attention given to co-regulation is an affirmation that self-regulation is not deemed to be adequate. In co-regulation the state imposes the obligation to institute a regulatory scheme and retains backstop authority. The thrust of the argument is to back down reliance on the state and increase reliance on the industry. The Ofcom definition in Table VI-3 is indicative of the thrust of this approach to regulatory change. It envisions a trade-off between the role of the state and the role of the industry. State authority certifies the co-regulatory structure. The partnership is between the state and the industry. There is little or no mention of any change in the role of the public.

Thus, I view the existing discussion of change in regulation as involving a substantial reduction in the role of the state's command and control over market actors and actions with little, if any, contemplation of an increase in the role of the public. I consider the self- and co-regulation arguments in the literature as overwhelmingly about deregulation, not about regulatory reform. Advocates assert that there really is no need for regulation, but, if there are problems, the enlightened self-interest of producers will call forth

collective, voluntary, purely self-regulatory actions to solve the problem. If this does not happen, then the threat of regulation is posited as enough incentive to induce producers to engage in effective self-regulation. Failing that, the government could mandate or stipulate self-regulation, but should not directly regulate. However, the self-regulation experimental phase is never limited in time and the conditions that indicate failure are never specified; nor are the actions that would be taken if failure is admitted. Co-regulation introduces a dollop of state assertion of authority with little involvement of either the state or the public. Co-regulation is intended to address the failure of self-regulation (primarily the incentive and collective action problems) with the state acting as a backstop, but depending primarily on producers to act.

This seems to be a treadmill never intended to get to effective regulation, and a review of the literature supports such a view. The available contemporary alternative regulation literature can easily reinforce the concern of those who fear alternative regulation is a cover for weak regulation. The literature provides a severely disproportionate amount of attention to the ways in which alternative regulation gives greater deference and influence to the industry interests that are affected by regulation.

Fortunately, co-regulation does not exhaust the possibilities for approaches to regulation that reduce the role of the state, however. There is some discussion of increasing the role of other stakeholders in the regulatory process. Collaborative and reflexive regulations envision broader notions of involving and representing **all** stakeholders and interests in the regulatory process. Participatory governance and civic regulation focus on the participation of civil society groups.

VII. PARTICIPATORY GOVERNANCE

This section picks up on the public participation threads in the literature and weaves them into an alternative. It argues that the narrow focus on expanding the freedom and influence of producers is unjustified as a general proposition and counterproductive to the effort to respond to the quarter-life crisis. There is every reason to believe that the pubic (consumers) can benefit from and contribute to improved regulation as much as industry (producers), just as end-user innovation has enhanced the performance of many areas of the digital economy.[10] Balancing the approach may also reduce political tension. If regulatory approaches can be identified that are seen as effective but more flexible than traditional regulation, resistance may be reduced on both sides.

A. The Continuing Need for Good Governance

1. Conditions that Favor Oversight

With all these alternative forms of regulation available, it is natural to ask whether certain characteristics of or conditions in a sector point toward different forms of regulation as likely to be more successful or preferable. The regulatory reform literature provides the key link between the maturation challenges and the alternative forms of regulation, as shown in Table VII-1.

Replacement is the central concept. Replacement occurs "when people can no longer do things off-line but can only perform them online, the government should then create guarantees for accessibility."[11] The shift of activity online and the nature of that activity lay the basis for regulation. In the case of the

10. *See* ERIC VON HIPPEL, DEMOCRATIZING INNOVATION (2005), *available at* http://web.mit.edu/evhippel/www/democ1.htm.

11. *Report from the Commission on European Governance*, EUR. COMM'N (2003), http://ec.europa.eu/governance/docs/comm_rapport_en.pdf; EUROPEAN COMMISSION, DUTCH GUIDELINES FOR REGULATION EUROPEAN GOVERNANCE: White Paper, European Commission, *translated* in STARTING POINTS FOR ICT REGULATION: DECONSTRUCTING PREVALENT POLICY ONE-LINERS 133 (Bert-Jaap Koops et al. eds., 2006).

Internet, it is a combination of things that could not be done offline and things that can be done much more efficiently online that creates the urgency to provide access and ensure that the activities that took place in physical space are available in cyberspace.

Replacement/High Risk: "when people can no longer do things off-line but can only perform them online. The government should then create guarantees for accessibility."[1]

Fundamental Rights/Strong Public Interest Concerns: – "[Co-regulation] is only suited to cases where fundamental rights or major political choices are not called into question,[1] Self-regulation is not suitable if fundamental norms and values of democratic rule or law are at stake… this holds especially with respect to protecting classic human rights of citizens and preventing and investigating infringements of the rule of law and state security. In these cases, agreements between parties cannot suffice and legislation will be necessary."[2]

Industry Lack of incentives/organization: "We will establish whether the industry has a real incentive to resolve the issue, rather than just a publicly stated intention… where such incentives do not exist, a purely self-regulatory solution is less likely to succeed. But a form of co-regulation may be appropriate if weaknesses in incentives can be strengthened through statutory regulation… we should consider the incentives for members to cheat… and what monitoring and enforcement measures could be put in place for the scheme to be effective."[3]

Heterogeneity of Products: "We should therefore consider whether measurable objectives and simple rules can be established for the operation of the scheme. This include considering the complexity of the citizen and consumer objective, the diversity of the companies potentially taking part, the number and complexity of the service covered, and the availability of expertise in designing a solution." [3]

Instability of Technology/ Heterogeneity of Products: "if… stability is achieved. Then to promote legal certainty, perhaps codification of norms established by self-regulation could take place."[2] "[Self-regulation] should not be used where rules need to apply in a uniform way." [2]

Source: [1] Dutch Guidelines for Regulation [2] European Governance: White Paper, European Commission, cited in **Bert-Japp Koops, et al., Starting Point for ICT Regulation, B-J Koops, et. al (Eds.), Starting Points for ICT Regulation, ITER, The Hague, 2006http://rechten.uvt.nl/prints/upload/20066279084231203 7944.pdf, 133-136,[3] Office of Communications, Identifying Appropriate Regulatory Solutions: Principles for Analysing Self- and Co-Regulation, 10-Dec-08http://stakeholders.ofcom.org.uk/consultations/coregulation/statement/, 16.**

Table VII-1: Characteristics that Place Limits on Self/Co-Regulation

When the activities that have been replaced involve fundamental rights or important political activities are at issue, the need for regulation is greater. The list of fundamental rights and important activities includes human rights, the rule of law, and state security. These are prominent in several of the maturation challenges that the Internet faces.

Where the need for regulation might be met with self-regulation, other considerations can mitigate against it, if the activities are so important that they cannot be left to uncertain self-regulation. Finally, where technology has stabilized significantly and there is a need for uniformity, self-regulation may not be the preferred approach because it cannot produce the desired homogeneity. Complex goals, complex products and services delivered by diverse companies raise concerns about the ability of self-regulatory schemes to succeed.

2. The Ingredients of Successful Alternative Regulation

With an array of diverse problems and a large set of possible solutions, it is critical to have a clear idea of what successful alternative governance would look like. The literature provides clear insights (see Table VII-2). Even reviews that are friendly toward reducing reliance on traditional regulation recognize that key weaknesses of the alternatives must be addressed.

Transparency/Openness
Clarity of Purpose
Dialogue
Consensus
Informing policy process
Influencing decisions
Planning
Implementation
Monitoring and evaluation
Data gathering and analysis
Clarity of Process/Rules
Governance
Convening
Decision rules
Voting
Unanimity (Veto)
Super Majority
Majority
Non-Voting
Rough Consensus
Right of Appeal, Dissent
Scope of "Authority"
Rules only
Review of operations & goals

Enforcement – Compliance
Accountability
Fairness
Speed
Appropriateness
Complaint and Audit
Adequacy of Resources

Participation
Public Awareness
Rights - Redress
Public consultation
Inclusiveness
Access
Representativeness
Organization of groups
Resources
Expertise
Role of independents
Adequacy of Resources
Overall
For NGOs
Industry Coverage
Achieve Critical Mass
Avoid "Capture" & Ballot packing

Legal Clarity
Relationship to government
Formal
Sponsored
Recognized
Status of Decisions
Safe Harbor
Reg.-Neg.
Sponsored
Recognized
Preferred
Advisory
Informal
Bully Pulpit- Nudge
Procurement
R&D
International

Desired Results
External
Credibility
Legitimacy
Effectiveness
Efficiency
Adaptability
Flexibility
Internal
Building Trust
Shared Knowledge & Expertise
Culture of Cooperation & Leadership

TABLE VII-2: ATTRIBUTES OF AN EFFECTIVE ALTERNATIVE REGULATION STRUCTURE[12]

The widely observed lack of openness and transparency points to a fundamental question of co-regulation as regards the scope of relevant stakeholders. Most of the systems do not include consumer or viewer/listener groups in a way, which provides for formal influence with the process of decision making. . . . While transparency is a generally accepted value of good regulation the openness to specific groups is a design feature of a co-regulatory system. How the interests are balanced defines the working of the system, its acceptance and legitima Even though the objective of regulatory reform is to reduce the role of the state, one of the key ingredients of success is political – the establishment of the legitimacy of the alternative regulatory process. Legitimacy is a quintessentially political concept that is accomplished by (1) designing internal structures and processes that are seen as participatory, transparent, and fair building trust, leadership, and skills among the participants and (2) achieving external results that are

12. HANS-BREDOW-INSTITUTE, *supra* note 125, at 118-23; European Governance, *supra* note 119, at 133-40; Bart Cammaerts, *Civil Society participation in multistakeholder processes: in between realism and utopia*, *in* MAKING OUR MEDIA: GLOBAL INITIATIVES TOWARD A DEMOCRATIC PUBLIC SPHERE 83 (Laura Stein, Dorothy Kidd, Clemencia Rodriguez eds., Hampton Press, 2009).

effective.

3. Expanding the Space for Alternative Governance

a. Constitutional and Collective Choice Decisions

The process by which the space for alternative governance can be expanded can be seen as a challenge in the realm of Constitutional and Collective Choice decision-making, as depicted in Figure VII-1, which uses the recommended principles of parliamentary reform discussed above.

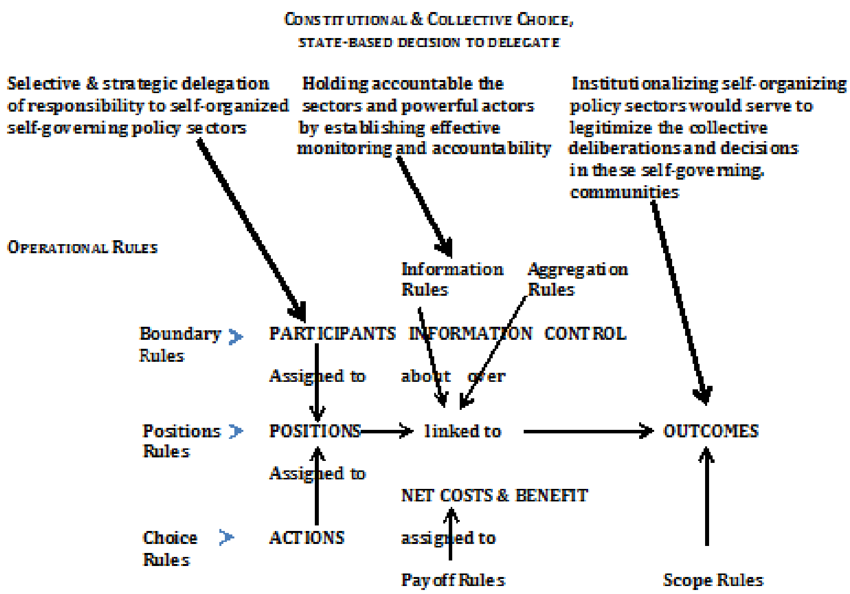


FIGURE VII-1: EXPANDING THE SPACE BETWEEN STATE AND MARKET

In building the legitimacy of alternative governance models in both the economy and the polity, the state has the important role of gracefully getting out of the way, while providing the important legal underpinning that makes significant contribution to the legitimacy of the alternative governance model. The state must provide legal clarity in selectively delegating more authority to autonomous, self-organizing policy sectors. Whether it chooses to delegate or regulate, it must reserve authority over areas where replacement has occurred and important values are at stake. In all cases, it is extremely important to seek to ensure that the institutions exhibit the key characteristics for successful oversight, including monitoring institutions for transparency, participation, and accountability.

The process of institutionalization discussed earlier is important. While it is clear that the state plays an important part in launching the authority of the alternative governance approach, over time, successful and effective alternatives build independent authority and trust. The ability of the state to revoke the authority shrinks. Eventually, any effort to rescind the authority becomes illegitimate.

b. Operational Framework for Participatory Governance

As described in Figure VII-2, participatory governance is envisioned as a multi-stakeholder process that involves industry, civil society, and technologists in both the writing and enforcement of rules. The ultimate goal is to foster compliance, rather than enforcement. The participants are the three sets of non-

governmental interests. The activities are rule writing and enforcement. It is supported by the state in the delegation decision.

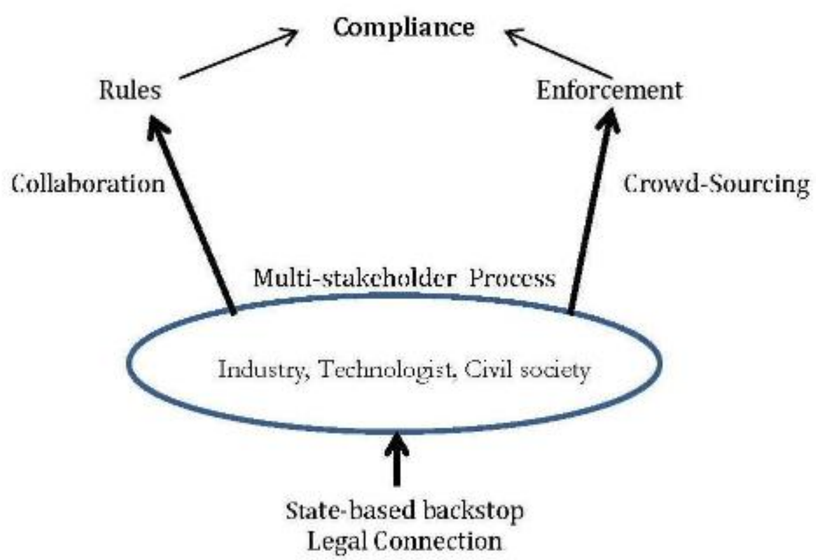


FIGURE VII-2: THE STRUCTURE OF PARTICIPATORY GOVERNANCE

We can envision two sets of possibilities, beginning with increasing activity that feeds into the regulatory process with the ultimate goal of shrinking the scope of regulatory process as the alternatives demonstrate their ability to do their job of governances (preserving the dynamic expansion of the Internet, while ensuring that the social goals are advanced).

Codes of conduct need to be developed by the multi-stakeholder process – not solely at the discretion of the industry. Codes of conduct that are developed through collaborative processes could be afforded special treatment by regulatory agencies and go into force on a fast track, but they need not be if self-regulatory enforcement and norms are strong enough. Enforcement of rules would open the door to crowd-sourcing enforcement in which the public participates directly. Complaints that are the result of the collaborative process could be granted special status and be handled in an expedited manner by the regulatory agency, or their enforcement could be through industry-based sanctions and processes.

In order to ensure that participatory governance attracts the participation necessary to make it effective and legitimate, it must fill the four voids left by the exit of the state (transparency, participation, legal clarity, and enforcement) and compensate for the failure of self-regulation. The right to appeal directly to the state would continue to exist, but the burden for success for complaints would be heavy for issues that had not been subjected to the participatory process. Complaints outside of the multi-stakeholder process cannot be prohibited, but they should bear a significantly heavier burden (a higher threshold and burden of proof). On the other hand, failure of businesses to participate should also come at a price, making complaints subject to accelerated consideration.

The most important ingredient is to ensure that the output of the new institutions is given a great deal of weight. This will provide an incentive to participate. The greater the authority of the intervening institutions, the more attention the structure should and will get. The multi-stakeholder group will have to be representative. Collaborative deliberation should be inclusive. In both cases, internal decision rules will have to be implemented (e.g., veto, super majority, majority, concurrence, and dissent).

The multi stakeholder processes would be subject to standards of representativeness, inclusiveness,

and participation, which are more explicit and likely to result in better representation than the current, inchoate approach that prevails in traditional regulation. Thus, the resulting structure will have a statutory core as the underlying legal foundation, but the bulk of the work of rule writing and enforcement will be transferred into the co-regulatory and participatory activities.

B. Enhancing the Democratic Process

Participatory governance can address many of the areas of concern about effective regulation. It can enhance public awareness, transparency, and independence of the regulatory structure by drawing members of the public and leaders of the public interest community into the process. Participatory governance also brings additional resources to enforcement, resources that are volunteered by the public in the form of participation, although the structure needs to provide additional resources for technical expertise.

The idea is to deepen democratic participation by building civil society institutions that fill the gap left by the traditional institutions of the polity. This idea has strong roots in democratic thinking in two highly developed aspects of democratic theory – the contemporary view of the public sphere and the traditional view of the press. I believe there are generally strong parallels between the two.

The unique role of the press as a civil society, public sphere institution that provides oversight over the polity and the economy has similarities to the role I envision for participatory governance. The above citations from the White Paper on representative democracy made this point directly. Elections are the primary form of participation in representative democracy that is no longer deemed sufficient for more knowledgeable, engaged publics. The press provides a primary oversight function of an engaged part of civil society.[13]

Democracy theorists and institution builders have believed for a quarter of a millennium that the press plays a central role in democracy by fulfilling two functions. The most prominent in their thinking was the role of the fourth estate to monitor and report on the other estates in society,[14] as shown in Table VII-3. However, in their prolific production of pamphlets they practiced the Fifth Estate function of mobilizing the populace to political action. The challenge with respect to participatory governance is to design structures that allow the Fifth Estate to compensate for the declining oversight functions of the state. Table VII-3 identifies the key functions of the press, which is defined as non-governmental oversight. It plays both mediated (Fourth Estate) and direct mobilization (Fifth Estate) roles.[15]

---

13. NORTH, *supra* note 15, at 54-55.

14. *Fourth Estate,* WIKIPEDIA, http://en.wikipedia.org/wiki/Fourth_Estate (last modified Sept. 17, 2012, 19:44) ("The Fourth Estate (or *fourth estate*) is a societal or political force or institution whose influence is not consistently or officially recognized. "Fourth Estate" most commonly refers to the news media; especially print journalism or "The Press". Thomas Carlyle attributed the origin of the term to Edmund Burke, who used it in a parliamentary debate in 1787 on the opening up of Press reporting of the House of Commons of Great Britain. Earlier writers have applied the term to lawyers, to the British queens consort (acting as a free agent, independent of the king), and to the proletariat. The term makes implicit reference to the earlier division of the three Estates of the Realm. In current use the term is applied to the Press, with the earliest use in this sense described by Thomas Carlyle in his book *On Heroes and Hero Worship*: "Burke said there were Three Estates in Parliament; but, in the Reporters' Gallery yonder, there sat a Fourth Estate more important far than they all." In Burke's 1787 coining he would have been making reference to the traditional three estates of Parliament: The Lords Spiritual, the Lords Temporal and the Commons. If, indeed, Burke did make the statement Carlyle attributes to him, the remark may have been in the back of Carlyle's mind when he wrote in his *French Revolution* (1837) that "A Fourth Estate, of Able Editors, springs up; increases and multiplies, irrepressible, incalculable." In this context, the other three estates are those of the French States-General: the church, the nobility and the townsmen. Carlyle, however, may have mistaken his attribution . . . .").

15. C. EDWIN BAKER, MEDIA, MARKETS, AND DEMOCRACY 149, 151 (2002). ("Complex democracy seeks a political process that promotes both fair partisan bargaining and discourses aimed at agreement.") (also asserting the press should be pluralist, providing individuals and organized groups with information that indicates when their interests are at stake and help mobilize people to participate and promote their divergent interests, making policymakers aware of the content and strength of people's demands. The press should promote agreement on a society-wide common good, by being inclusive and promoting thoughtful discourse, not merely being factually informative, and supporting reflection and value or policy choice. The press should promote self-reflection, informing the public about itself, so that those who disagree with the dominant opinion can contest it and provide criteria to measure government responsiveness.).

Role	Relationship to the Public	Function	Complex Democracy's Ideal Media
Fourth Estate	Mediated	Monitorial	The Checking function Independent of both government and private economic power Grounded in the pluralism of the life world Nurture non-market structures to capture positive externalities
Fifth Estate	Direct	Participatory	Participatory Democracy's Ideal Media Pluralist: Distribute politically and culturally salient media in an egalitarian manner Supports interest group formation Mobilize interests Convey public opinion to policymakers Communal: promote agreement on common good Inclusive Thoughtfully discursive Self-Reflective Inform public about itself Contest dominant opinion Criterion to measure government responsiveness

TABLE VII-3: JOURNALISM AS A PARADIGM FOR NON-GOVERNMENTAL OVERSIGHT[16]

I refer to the Fifth Estate for ease of reference and because the concept is being applied to the impact of the Internet on the contemporary communications and media landscape. It captures the essence of the direct participatory role of the public. Dutton describes the Fifth Estate[17] as follows:

> More generally, the networks comprising the Fifth Estate have two key distinctive and important characteristics: 1. The ability to support institutions and individuals to enhance their 'communicative power' . . . by affording individuals opportunities to network within and beyond various institutional arenas. 2. The provision of capabilities that enable the creation of networks of individuals which have a public, social benefit (e.g. through social networking Web sites).[18]

The analogy between the press and participatory governance can be strengthened by locating these two institutions within the public sphere.[19] The public sphere mediates between the private sphere (which comprises civil society in the narrower sense, the realm of commodity exchange and of social labor) and the Sphere of Public Authority, which deals with the state. The public sphere crosses over both these realms. Through the vehicle of public opinion it puts the state in touch with the needs of society. This area is a site for the production and circulation of discourses, which can be critical of the state. These distinctions

---

16. *Id.* at 129-53.

17. My use of the term "5th estate" has similarities and differences with the use Dutton makes of the term. Dutton, *infra* note 129. I agree that the emergence of the 5th estate stems for the dramatic expansion of access to information and the ability to communicate across institutional and geographic boundaries. I disagree with the suggestion that the 5th estate can supplant the 4th estate without building structures that are intended to accomplish that purpose. Interestingly, the only other reference to the explicit use of the term 5th estate that Dutton makes is to a web site that adopted the name. The web site described itself as serious and satirical commentary and appears to be defunct (with no entry after July 2009). This example underscores the two characteristics of the 5th estate that distinguish it from the 4th estate. It is largely commentary and its durability over time at the level of individual organizations is suspect. Others have argued that the 5th estate is necessary to monitor the 4th estate. Ironically, if the 4th estate were doing a better job, the need for and role of the 5th estate in this regard would be reduced, but its broader role in democratic discourse would continue.

18. William H. Dutton, *The Fifth Estate Emerging Through the Network of Networks*, 27 PROMETHEUS 1, 3 (2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1167502.

19. Here I paraphrase the formulation offered in Wikipedia. Wikipedia is a perfect example of how the public sphere has expanded through the creation of new forms of mass communications. *See Public Sphere*, WIKIPEDIA, http://en.wikipedia.org/wiki/Public_sphere (last modified Sep. 5, 2012, 21:11).

between state apparatuses, economic markets, and democratic associations are essential to democratic theory. The study of the public sphere centers on the idea of participatory democracy and how public opinion becomes political action.

Figure VII-3 depicts a map of the media in a public sphere that has become much more complex and the make-up of the media much more diverse. The Figure is drawn to emphasize the fact that the growth has been in those areas of the media that are best suited to Fifth Estate functions. The challenge is to harness the Fifth Estate energy to accomplish the Fourth Estate oversight functions.

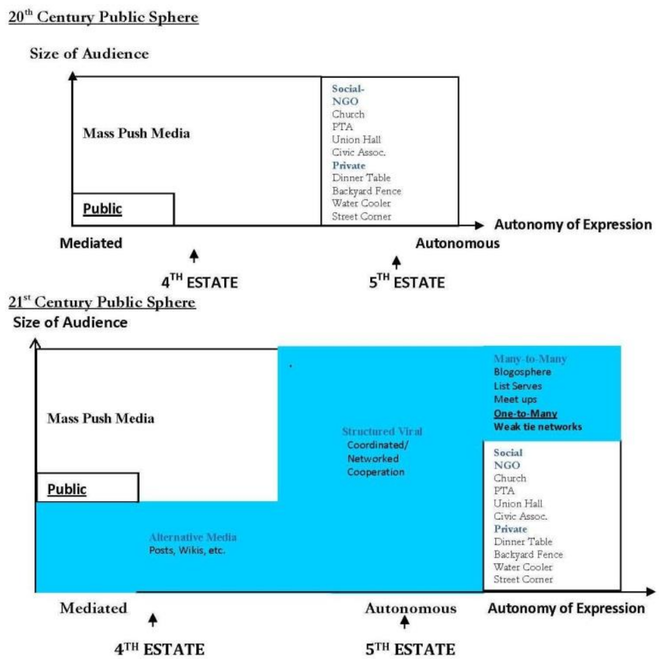


FIGURE VII -3: INCREASING DIVERSITY IN THE EXPANDING DIGITAL PUBLIC SPHERE

The Fifth Estate function is distinct from the Fourth Estate function, although it is generally hoped that monitoring society and informing the public will get them to act, but mobilizing is a different type of activity and the ability of Fourth Estate activity to mobilize people in the 20th century is debatable. The ability of unmediated viral communications to create strong collective action in the digital age has been widely noted.[20] Unmediated communications predominates in cyberspace because the medium is naturally suited to do this. There is a lively debate about whether the commercial mass media accomplished it function in the 20th century when commercialism overwhelmed journalism.[21] The goal of participatory governance is

20. *See, e.g.*, CLAY SHIRKY, HERE COMES EVERYBODY: THE POWER OF ORGANIZING WITHOUT ORGANIZATIONS, 2009; REBECCA MACKINNON, CONSENT OF THE GOVERNED: THE WORLDWIDE STRUGGLE FOR INTERNET FREEDOM, 2012.

21. BAKER, *supra* note 131, at 184, 187, 191 (The critique of 20th century journalism stems in large measure from the fact that its functions became obscured by its transformation into a commercial mass media enterprise.) ("[C]omplex democracy fears that the watchdog will be muzzled, whether by government or private power. . . .[M]onopolization or corrupted segmentation will suppress or disfigure media pluralism," because "[m]arket-determined segmentation predictably disfavors, for example, media focusing on political ideology, non-market-valued ethnic and cultural divisions, economically poorer groups . . . . When properly performing its various democratic functions, the media generates significant positive externalities – that is, benefits to people other than the immediate consumer of the product. The economic meaning . . . is that . . . free markets will under-produce these quality products.").

to expand the role of public sphere institutions as the state role shrinks. In the analogy to the press, I propose that participatory regulation can play a Fourth Estate function and infuse it with Fifth Estate energy.

B. Conclusion

Because the Internet and the digital networks on which it rides have become central institutions in societal and global communications and commerce, they can be described as "affected with a public interest."[22] The concept of public obligations falling on private enterprises is as old as capitalism itself.[23] While this term might strike fear into the hearts of some Internet stakeholders, because it evokes the specter of the utility-style common carrier regulation of the 20th century, the concept has a much longer and richer history that encompasses many forms of regulation that are much less intrusive.

While common carrier, public utility regulation was applied to certain large infrastructure industries over the course of the 20th century, many activities deemed to be affected with the public interest have been governed by criminal[24] and common law[25] (e.g., restaurants and other public places), prudential regulation (e.g., banks and insurance companies), or subject to self-regulation (e.g., professions like medicine and law).

On the one hand, it can be argued that in the 500-year history of the treatment of the public interest in capitalist society, command and control regulation is the exception, not the rule. On the other hand, it can also be argued that in the 500-year history of capitalism, the means of communications and transportation of commerce have always been regulated and have been required to shoulder unique responsibilities.

Thus the history of the concept of "affected with a public interest" argues for a careful consideration, not whether the Internet should shoulder new responsibilities, but how the obligations that the digital revolution must shoulder can be implemented in a way to preserve its dynamic nature. There is no reason to believe that one-size will fit all. In fact, the challenges have different causes and interact with the Internet ecology in different ways. Therefore, different institutional structures are likely to be better suited to meet specific challenges.

This analysis indicates that the successful model should not be asked to take on tasks for which it is not well suited. Internet governance involved highly technical issues that were debated primarily by technicians in an open format. The challenges that are primarily economic, social, and political will be difficult for the Internet institutions to deal with. The ability to separate technical from policy issues is sufficient to promote this balanced outcome. To a significant degree technology creates possibilities, while policies influence which paths are chosen. The perception of the nature of the challenges varies greatly

22. *Business Affected with a Public Interest*, THEFREEDICTIONARY.COM, *available at* http://legal-dictionary.thefreedictionary.com/Business+Affected+With+a+Public+Interest (last visited Sept. 12, 2012) ("A commercial venture or an occupation that has become subject to governmental regulation by virtue of its offering essential services or products to the community at large. A business affected with a public interest is subject to regulation by the Police Power of the state to protect and to promote the General Welfare of the community which it serves. Such a designation does not arise from the fact that the business is large, or that the public receives a benefit or enjoyment from its operation. The enterprise, as a result of its integral participation in the life of the community or by the privilege it has been granted by the state to serve the needs of the public, is regulated more strictly by the state than other businesses. What constitutes a business affected with a public interest varies from state to state. Three classes of businesses have been traditionally regarded as affected with a public interest: (1) those carried on pursuant to a public grant or privilege imposing a duty of making available essential services demanded by the public, such as common carriers and Public Utilities; (2) occupations considered from the earliest times in common law to be exceptional, such as the operation of inns or cabs; and (3) businesses that although not public at their inception have become such by devoting their activities to a public use, such as insurance companies and banks. A business affected with a public interest remains the property of its owner, but the community is considered to have such a stake in its operation that it becomes subject to public regulation to the extent of that interest.").

23. *See* James Speta, *A Common Carrier Approach to Internet Interconnection*, 54 FED. Comm. L.J. 225, 254 (2002).

24. *Criminal Law*, WIKIPEDIA, http://en.wikipedia.org/wiki/Criminal_law (last visited Sept. 11, 2012).

25. *Common Law*, WIKIPEDIA, http://en.wikipedia.org/wiki/Common_law (last modified Oct. 1, 2012, 17:15); *Civil Law (Common Law)*, WIKIPEDIA, http://en.wikipedia.org/wiki/Civil_law_(common_law) (last modified Oct. 1, 2012, 20:57).

across stakeholders and nations, with some seeing the functionalities technology provides as positive or negative, depending on the point of view of the stakeholder. In every area, technology has two sides, as noted above. For example,

- The ability to gather, store, and seamlessly transfer large quantities of information about consumers is seen as a threat to privacy by public interest advocates, while content owners and Internet companies see it as a positive way to fund and target the distribution of content and services.
- The ability to gather, store, and seamlessly transfer large quantities of perfectly replicable data is seen as a threat to intellectual property by content owners, who brand it as piracy, while public interest advocates see it as a major improvement in the ability of consumers to make fair use of content.
- The ability to monitor and prevent disruptive uses of the Internet is seen as an important tool to improve cyber security by some, or as a threat to freedom of speech, an invasion of privacy, or denial of freedom of assembly, by others.
- The winner-takes-most nature of digital markets that creates huge, dominant entities in many areas of the digital economy is seen as the efficient outcome by some and a major threat of abusive market power by others.

If we try to solve each of these important social policy challenges by tinkering with the basic structure of the resource system to impose changes, we run a very high risk of destroying its core structure (its communications protocols and governance institutions) and undermining its ability to function at the high level to which we have become accustomed. Responses to the maturation challenges should be crafted at the layer and in the realm in which they arise. Because the digital revolution has had such a profound and beneficial impact across all the realms of social order, reaching across layers and realms to solve problems is likely to have negative, unintended consequences. This is particularly true when the technology layer is involved.

The goal of a communications standard is to make activity possible. The more activity the standard supports, the better. The goal of policy is to direct activity in socially beneficial directions and dissuade socially harmful actions. The combination of successful self-regulation of the Internet and the light handed regulation of nondiscrimination on the telecommunications network was the bedrock of the digital revolution and produced decades of unparalleled innovation and growth in communications. They deserve a great deal of deference. Above all, those who would abandon the model or break the Internet altogether by abandoning its principles bear a heavy burden of proof. This applies to governments, network operators and civil society groups.

WHY GROWING UP IS HARD TO DO: INSTITUTIONAL CHALLENGES FOR INTERNET GOVERNANCE IN THE "QUARTER-LIFE CRISIS" OF THE DIGITAL REVOLUTION

MARK COOPER*

VI: GOVERNANCE INSTITUTIONS FOR THE DIGITAL REVOLUTION

A. Principles for Adaptation of Internet Governance

The combination of the weakness of the competing institutions (the market and the state) and the success of the Internet resource system suggests that enhancing the polycentric institution between the market and the state remains a viable, preferable approach to respond to the challenges. But, it is also clear that the existing institutions must adapt to meet the challenges. This section offers a series of principles for adapting Internet governances to the maturation challenges derived from the conceptual and empirical framework described earlier. It lays the foundation for the argument in the next section that "participatory governance" is a critically important institutional innovation needed to preserve and extend the success of the Internet resource system. It locates the concept in relation to the Internet governance debate, the broader crisis of legitimacy of the state, and the ongoing debate over regulatory reform.

1. Priorities for Preserving the Internet Principles by Expanding the Space of Governance Between Market and State

Meeting the challenge of "how we shift from 'government to governance' . . . relat[ing] traditional steering activities . . . with broader coordination tasks that . . . combine the multiple perspectives and needs of all institutional and noninstitutional Internet users"[1] requires an approach that

- recognizes the state will almost certainly be the origin of the fundamental steering choices, but
- ensures that it sets a course that preserves the Internet principles, while expanding the scope of autonomy between the market and the state.

I have argued that this was exactly the effect of the late 1960s Carterphone and Computer Inquiry proceedings and the decision to "unlicensed" some spectrum, so this is not an impossible task. Moreover, the understanding that this is the essential challenge permeates the Internet governance debate. The International documents discussed in Section III recognize the balance that must be struck between policy goals and the preservation of the dynamic Internet resource system. Table VI-1 adds to this body of evidence in a somewhat different way. It summarizes four analyses from the 2004-2005 period, which was a high point in the international debate over Interne governance because of the approach of the World Summit on the Information Society meeting in Tunis.[2] These are fairly comprehensive discussions that included explicit recommendations. They can be summarized in a small number of principles to guide the adaptation of the Internet governance substantive policymaking effort.

Structure and Units

1. To the greatest extent possible, preserve the end-to-end principle based on open, non-proprietary standards.
2. Recognize that markets have played a central role in deploying infrastructure and developing applications to drive Internet success, but

* *Journal on Telecommunications and High Technology Law,* 11:1 (2013).

1. PAVAN, *supra* note 19, at xxix.
2. *See World Summit on the Information Society*, WIKIPEDIA, http://en.wikipedia.org/wiki/World_Summit_on_the_Information_Society (last modified Aug. 18, 2012, 10:54 PM).

3. policy must also recognize that (a) the threats of scarcity and the exercise of market power require vigilant attention; (b) the political goal of the flow of information is not always synonymous with private or governmental interests; and (c) the social goal of universal service is not guaranteed by markets.

Users and Uses

4. Protect free flow of information, recognizing that both good and bad information may flow freely and states or private corporations are not always the best arbiters of which is which.
5. Promote the universal deployment of resources for development and the widest possible array of uses, which are the fundamental measure of success of the resource system.

Management and Governance

6. Apply a broad subsidiarity principle to policy, which means, in general, tasking institutions with responsibilities for which they are well-suited and, in particular, not burdening technical standards with socio-ecological policy responsibilities to the greatest extent possible.
7. Strengthen polycentric, inclusive, multi-stakeholder governance institutions.

MATURATION CHALLENGES[3]

2. The Multi-stakeholder Approach to Governance

a. Support for Multi-stakeholder Approaches in the Internet Space

One area where there has been considerable consensus at a high level of generalization in the Internet governance debate involves the institutional process for policymaking. For most of the issues raised, it is generally accepted that adaptation should flow from the existing institutions that have relied on multi-stakeholder principles. Where multi-stakeholder institutions are absent, they should be created. The observations on governance process of the three international groups identified in Section III are summarized in the top part of Table VI-2. The goals of participation, transparency, fairness, and data-based decision-making are endorsed with few countervailing concerns. Thus the conception of how multi-stakeholder processes should work is universally supported.

The bottom part of Table VI-2 reflects the magnitude of the challenge in another way. It shows the four sets of Internet stakeholders identified by the WGIG document. Each of the stakeholder groups corresponds fairly closely to one of the realms of social order. Moreover, the four sets of stakeholders have a great deal to do. The essential challenge for the multi-stakeholder process is to get the many different sets of stakeholders to collaborate to ensure that they all fulfill their long list of responsibilities.

3. Petru Dumitriu, *The World Summit on the Information Society (WSIS): From Geneva (2003) to Tunis (2005). A Diplomatic Perspective*, *in* MULTISTAKEHOLDER DIPLOMACY, CHALLENGES & OPPORTUNITIES 33 (Jovan Kurbalija & Valentin Katrandijev eds., 2006); Milton Mueller, John Mathiason & Lee W. McKnight, *Making Sense of* "*Internet Governance": Defining Principles and Norms in Policy Context*, *in* INTERNET GOVERNANCE: A GRAND COLLABORATION 100 (Don MacLean ed., 2004); William J. Drake, *Reframing Internet Governance Discourse: Fifteen Baseline Propositions*, *in* INTERNET GOVERNANCE: A GRAND COLLABORATION 122 (Don MacLean ed., 2004); *UNCTAD*, *supra* note 51.

Key to Sources: Petru Dumitriu, "The World Summit on the Information Society (WSIS): From Geneva (2003) to Tunis (2005). A Diplomatic Perspective, "**in** J. Kubalija and V. Katundjun (Eds.) Multistakeholder Diplomacy, Challengers & Opportunities (2006); **Milton Mueller, John Mathiason and Lee W. McKnight, "Making Sense of 'Internet Governance': Defining Principles and Norms in Policy Context in Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004);** *William Drake, Reframing Internet Governance Discourse: Fifteen Baseline Propositions, In Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004);* United Nations Conference on Trade and Development (UNCTAD), "Internet Governance," in Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004).

PRINCIPLES	PURPOSES
Structure & Units	
The global commons	**The Internet is based on global open, and non-proprietary standards. They are published and accessible to anyone without payment of fees.**

POLICY RECOMMENDATIONS: We need to keep those doors open. Nevertheless, maximum caution is necessary when attempting to privatize essential commons. **Do not allow the commons to be privatized.**

End-to-End Principle	**Architectural principle creates an interoperable, neutral, transparent platform supporting a wide variety of applications and services**

POLICY RECOMMENDATIONS: Preserve the technical standard Management of resources should not be overloaded with policy... Resource allocation should be consistent with the end - to-end principle... Regulation of the fraudulent and criminal activity must be directed at responsible endpoints, not at the internetworking process itself. In all these cases, the substantive character of the issue at hand, rather than the fact that the Internet is the medium through which the problematic activity is conducted, should be the determining criterion as to what level of "governance" (from consensus building and cooperation to rule-making) and what instruments should be applied.

Inclusiveness	**The Internet has been driven "from the bottom up"**

POLICY RECOMMENDATIONS: This feature could be enhanced by consolidating or by building from scratch governance structures that are genuinely open and inclusive of governments. *The effective inclusion of developing countries requires much greater attention.... Greater attention is needed to the inclusion of civil society organizations, small and medium-sized enterprises and individual users.* First, it must be recognized that whatever the merits of the case for their reform, the loose constellation of organizations that have so far underpinned the development of the Internet have achieved remarkable success in ensuring the stability and unit of a highly decentralized network of networks with no centre and not strong rule-making authority... In order for any reform proposal to be viable, not just technically but also politically, it must provide strong evidence that it will ensure the continued stability and quality of service of the Internet, prevent its fragmentation and maintain the "bottom-Up" processes through which standards and policies have been developed so far. *Technical and policy issues often cannot be neatly separated*

Private Market	**Fosters decentralized, small scale investment and variation in approach**

POLICY RECOMMENDATIONS: Do not transform standards commons into a basis for regulating the private market. *With respect to the substance of rule systems, efficiency means devising frameworks that do not inhibit technological change, unduly constrain the development of markets, or make it difficult for governments and stakeholder to reach agreements.* No one size fits all solutions are likely to emerge... a number of questions in which technological and policy issues are particularly intertwined are likely to be best treated within a network of international frameworks (as opposed to a unified, structured organization) of cooperation and coordination for the development of the Internet... In such a cooperative framework flexibility should be a paramount consideration... Structural flexibility and lightness are also needed in order to prevent governance solutions from being rendered obsolete by technological evolution.

Functionality/ and *Congruence*	**The Internet... development actually started from the need to perform a function.**

POLICY RECOMMENDATIONS: If we decide to use the Internet as a tool for achieving social development objectives, the governance model we follow should not be meant only to monitor, to restrict and to regulate. We need to allow and enhance functionality by representing and adequately using a balance of interests, capabilities and needs that exist in exist in real life. *Efficiency concerns suggest that form should follow function to the extent possible... In general terms, it is desirable to optimize institutional forms so that they match the issues to be managed. This overarching concern applies to both the substantive rules and institutional procedures in governance mechanisms.* [E]volution is more likely to produce results than a voluntarist top down approach. The current system of management of core Internet resources is the result of a process that has taken place over a remarkably short time. It is clear that this evolution has not yet reached a stage of maturity that is acceptable to all stakeholders. It must also complete a process of genuine internationalization (which is not necessarily equivalent to full-fledged intergovernmentalization, but which implies representatively requirements beyond the participation of individuals/organizations of various nationalities. In doing so it is essential to reconcile demands for change with the need to ensure continued delivery of the critical services.

Users and Uses

Moral Neutrality **Self-reliance**	**Transparency, speed and accessibility of information and content and services. But this communications enabling power applies to "bad ""as well as "good" information communications behavior.**

POLICY RECOMMENDATIONS: Private networks or users can build electronic "fences" or adopt filters or practices that can, to some extent, shelter themselves from undesirable forms of while maintaining some form of compatibility and interconnection with the rest of the world. Whereas and traditional notions of government and governance imply uniformity, Internet permits variation in policies adopted in response to the same problem.

Resource scarcity, Scale and dependence concentration, & control	**increase value of control**

POLCY RECOMMENDATIONS: Concentration and control raise legitimate grounds to investigate bottlenecks and the economic and political impact of legacy control. *Equity concerns are equally important and will become more so as the Internet becomes increasingly pervasive and thus affects a wider range of social interests.... What about situations... where concentrated market structures allow powerful firms to in effect set generally applied rules via their business strategies, rather than through collaborative decision making?*

Internet for development Infrastructure development should be decentralized and competitive

POLICY RECOMMENDATIONS: In order to help governments reach their economic and social aims, one should not look for methods to control the Internet, but for means to use its comparative advantage and prevent ICTs from becoming a factor that broadens, Instead of narrows, divides... We need to turn the technological advances into economic and social benefits; to attach societal assets to technological virtues, and to explore potential that have been unchartered. **Digital divide subsidies, if there are to be any, should go to end users and not to centralized suppliers or governments. Providing resources to end users...to acquire those elements of end user infrastructure should serve to stimulate and encourage development while maintaining a maximum degree of choice and diversity in supply.**

Governance

Polycentric **Multi-stakeholder**	**Distributed and multifarious, cannot be regulated in a top down manner** *Internet governance involves a heterogeneous array of formalized public and private sector rules that vary widely in their institutional attributes. Entails a heterogeneous and highly distributed array of prescriptions and processes that reflects the Internet's core features rather than centralized "one size fits all" control over a single system.* Spontaneous expression of the consensus and discipline of the main players on the use of standards and protocols

POLICY RECOMMENDATIONS: Multistakeholder governance should be encouraged government, private business, civil society and international organizations. If we replace the naturally normative work that has been emerging spontaneously with more systematic work, we need a common understanding of what should be expected from the parties involved. After defining those contours of governance, we may gradually move toward agreement on rules, decision-making procedures, and institutions. *Viewing these governance mechanisms in an integrative manner would allow us to evaluate the full diversity of public and private sector practices that help to shape bot the infrastructure and transactions and content, to systematically assess what works... and to consider whether there are any holes, tensions or cross- cutting issues... [I]f properly structured, it could well build a stronger global consensus that would underpin the Internet's continuing growth as an open and vibrant medium.* <u>A sustained effort of capacity building for Internet policy making is needed so that the majority of the developing countries can effectively participate in the management/governance systems.</u>

Specialization	Inclusion does not rule out specialization as a prerequisite for efficiency and effectiveness.

POLICY RECOMMENDATIONS: Internet governance should count on specialization. The separate and complementary functions of public and private governance structures, the legitimate roles of different actors, and the need to create organic and as building blocks.

Self-restraint Accountability	The highly technical nature of the work on standards and protocols does not imply ignoring social consequences.

POLICY RECOMMENDATIONS: While accepting the need for more governance, it is equally important for public policy to refrain from regulating what does not need to be regulated. Normal democratic procedures... will inevitably be slow in an environment of rapid change and technological development. Governments should be knowledgeable about prospects in the technical field. The same conclusion is valid for national policies and laws of the powerful countries when they set rules that affect the global community. *If they are not designed to maximize efficiency and flexibility, they may not be functionally effective or politically sustainable.* <u>Of course, it is not possible to establish a clear-cut separation between all infrastructural/technical matters on the one side and political and socio-economic questions on the other. Policy decisions very often have technological implications and vice versa. A crude device to categorize public policy issue that need to be addressed and the responses that could be explored in each case could be to distinguish between the management of the Internet as a global utility and the international governance issues posed by the use people make of the utility.</u>

TABLE VI-1: FOUNDATIONS OF INTERNET SUCCESS AND RECOMMENDATIONS FOR RESPONDING TO THE

Purposes and Principles

WORKING GROUP ON POLICY MAKING

Meaningful participation in global policy
Multi-stakeholder forum to address Internet-related policy issues
Functions: Audit, Arbitration, Coordination
Regulation Structure: multilateral, transparent
Ensure transparency, fair process, and accountability
democratic inclusive: governments, private sector, civil society,
Regional, national International coordination, International Orgs.

OECD PRINCIPLES FOR INTERNET GOVERNANCE

Encourage multi-stakeholder co-development operation in policy development processes:
Foster voluntarily developed codes of conduct
Develop capacities to bring publicly available, reliable, data into the policy-making process:
Limit intermediary liability
Give appropriate priority to enforcement efforts

UNESCO CODE OF ETHICS

Member states are responsible for ensuring an an inclusive, relevant, up-to-date and legal environment for the development of the information society

Sources: OECD, *Communiqué on Principles for Internet Policy-Making*, OECD High Level Meeting, The Internet Economy: Generating Innovation and Growth, Paris, June 28-29, 2011; *Report of the Working Group on Internet Governance*, Chateau de Bossey, June 2005.

Internet Stakeholder Groups and Responsibilities

Governments (Polity)

Public policymaking and coordination and implementation, as appropriate, at the national level, and policy development and coordination at the regional and international levels.
Creating an enabling environment for information and communication technology (ICT) development.
Oversight functions.
Development and adoption of laws, regulations and standards.
Treaty-making.
Development of best practices.
Fostering capacity-building in and through ICTs.
Promoting research and development of technologies and standards.
Promoting access to ICT services.
Combating cybercrime.
Fostering international and regional cooperation.
Promoting the development of infrastructure and ICT applications.
Addressing general developmental issues.
Promoting multilingualism and cultural diversity.
Dispute resolution and arbitration.

Civil society (Socio-cultural)

Awareness-raising and capacity-building (knowledge, training, skills sharing).
Promoting various public interest objectives.
Facilitating network-building.
Mobilizing citizens in democratic processes.
Bringing perspectives of marginalized groups, including, for example, excluded communities and grass-roots activists.
Engaging in policy processes.
Contributing expertise, skills, experience and knowledge in a range of ICT policy areas.
Contributing to policy processes and policies that are more bottom-up, people-centred and inclusive.
Research and development of technologies and standards.
Development and dissemination of best practices.
Helping to ensure that political and market forces are accountable to the needs of all members of society.
Encouraging social responsibility and good governance practice.
Advocating for the development of social projects and activities that are critical but may not be "fashionable" or profitable.
Contributing to shaping visions of human-centred information societies based on human rights, sustainable development, social justice and empowerment.

The private sector (Economy)

Industry self-regulation.
Development of best practices.
Development of policy proposals, guidelines and tools for policymakers and other stakeholders.
Research and development of technologies, standards and processes.
Contribution to the drafting of national law and participation in national and international policy development.
Fostering innovation.
Arbitration and dispute resolution.
Promoting capacity-building.

Academic/technical Community (Technology).

The contribution to the Internet of the academic community is very valuable and constitutes one of its main sources of inspiration, innovation and creativity.
Similarly, the technical community and its organizations are deeply involved in Internet operation, Internet standard-setting and Internet services development.
Both of these groups make a permanent and valuable contribution to the stability, security, functioning and evolution of the Internet. They interact extensively with and within all stakeholder groups.

Source: Report of the Working Group on Internet Governance, Chateau de Bossey, June 2005

TABLE VI-2: PRINCIPLES AND STAKEHOLDERS FOR INTERNET GOVERNANCE

b. Broader Challenges of Legitimacy

The interest in a multi-stakeholder approach is not only consistent with the organic Internet governance institution,[4] it also responds to the perceived decline in the legitimacy of the state. An EU White Paper from 2003 on parliamentary democracy notes the challenge of maintaining the connection between representative political institutions and the public as the information age progresses.

> Parliamentary territorial representation entails the involvement of a select few in law- and policy-making and provides a reliable basis for well-organized deliberation and decision-making. It enables in many cases more or less effective and reliable legislative action judged to be legitimate. Of course, such arrangements risk a de-coupling between Parliament and "the people." Two institutional arrangements were supposed to limit such de-coupling, namely regular parliamentary elections and a free press. But, as suggested in this [p]aper, much more is needed. Modern citizenry does not consist of a homogeneous mass public, or merely supporters of one or more parties. They are increasingly complex in their judgments and engagements. They make up an ensemble of publics and differentiated interests and competencies.[5]

Thus, the fundamental challenge in the economy of preserving a dynamic diverse product space in which consumers play a more active role has a direct parallel in the polity. A diverse, knowledgeable citizenry that wants to be and is engaged in the policy process challenges the incumbent institutions. It can be argued that the Internet is ahead of the polity in that it has provided a partial solution that took this

4. *See* Mueller, *supra* note 19, at 217 (calling them "Organically Developed Internet Institutions.").

5. T.R. Burns, *The Future of Parliamentary Democracy: Transition and Challenge in European Governance*, green paper for the *Conference of the Speakers of European Union Parliaments*, CAMERA DEI DEPUTATI (IT.)(Sept. 22-24, 2000). http://www.camera.it/_cppueg/ing/conferenza_odg_Conclusioni_gruppoesperti.asp.

direction, but it should also be recognized that the framework for promoting and channeling civil society engagement to build a legitimate and effective set of institutions is a work in progress.

The key to achieving the goal of enhancing democratization identified in the White Paper is that as the state recedes; it must use the remaining "legal connection" to promote participatory governance to ensure a larger direct role for the public. The principles of parliamentary reform offered as a response to this growing democratic deficit can be applied broadly to governance.

> [W]e suggest consideration of reforms of parliamentary functions, role, and institutional arrangements guided by principles such as the following:
>
> The principle of exercising high selectivity – with respect to the policy areas in which Parliament engages itself directly, for example in the formulation of specific or detailed laws and policies. This calls for explicit consideration of the reasons for such focused involvement.
>
> The principle to delegate whenever possible – a form of subsidiarity principle – to self-organizing policy sectors, at the same time holding accountable these sectors or key or powerful actors in these sectors. Part of this entails establishing effective monitoring and accounting arrangements.
>
> Institutionalizing these self-organizing policy sectors would serve also to legitimize the collective deliberations and decisions in these self-governing communities.
>
> The principle of focusing on strategic problems and issues that cannot be readily delegated or dealt with through private interests or civil society . . . .[6]

This is a road map for transferring active decision-making from the state to civil society. It is consistent with Ostrom's observations on the nesting of governance of resource systems in complex environments.

> Given the wide variety of ecological problems that individuals face at diverse scales, an important design principle is getting the boundaries of any one system roughly to fit the ecological boundaries of the problem it is designed to address. Since most ecological problems are nested from very small local ecologies to those of global proportions, following this principle requires a substantial investment in governance systems at multiple levels—each with some autonomy but each exposed to information, sanctioning, and actions from below and above.[7]

3. The Many Flavors of Alternative Governance

Reflecting the central theme of increasing direct participation in governance, Figure VI-1 arrays the various approaches to governance along two dimensions—the extent of state involvement and the extent of public involvement. I use the term "alternative governance" because a number of adjectives have been used to describe both the substance and process of regulatory change.[8] At the origin, the role of the industry is dominant. Along the X-axis the role of the state increases. Along the Y-axis the role of civil society increases.

---

6. *Id.* (bullet points removed).

7. OSTROM, *supra* note 31, at 258 (citations omitted).

8. Much of the argument for alternative regulation has its origin in the experience of environmental regulation, but the concept has spread to the information, communications and media sectors. *See* Neil Gunningham, *Compliance, Enforcement and Innovation*, ORG. ECON. CO-OPERATION & DEV. (2004), http://www.oecd.org/environment/environmentinemergingandtransitioneconomies/33947825.pdf; Neil Gunningham, *Regulatory Reform Beyond Command and Control*, AMSTERDAM CONF. ON THE HUM. DIMENSIONS GLOBAL ENVTL. CHANGE (May 26-27, 2007), http://www.2007amsterdamconference.org/Downloads/AC2007_Gunningham.pdf.

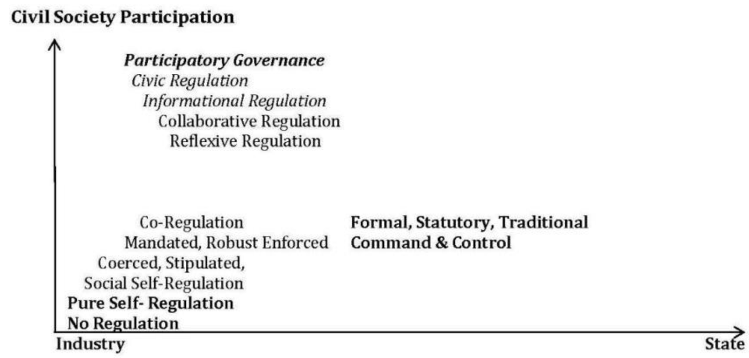


FIGURE VI-1: THE GROWING STOCK OF REGULATORY APPROACHES

Table VI-3 provides definitions for the various types of regulation that have been discussed in the literature. They are listed in order running from least to most regulatory, as I understand the thrust of the underlying concepts.

There are two polar opposites identified in this approach – "no regulation" is the least regulatory and traditional regulation the most. No regulation is the condition in which the transaction is not governed by direct involvement of the state or any explicit regulatory mechanism. Rather, the invisible hand of the market is presumed to ensure socially desirable outcomes.[9] At the opposite extreme, traditional, formal, statutory regulation occurs where the state (through its representative institutions) sets the goals and empowers the administrative apparatus of the state to write, implement, and enforce rules. Between the polar opposites, we have long had a number of mixed approaches and the number has been growing in the past two decades. Pure self-regulation occurs where the sellers in the market band together to produce rules to discipline the behavior of sellers in the market, presumably to promote the common interest of the sellers. In the case of pure self-regulation, sellers adopt the institution of regulation on a purely voluntary basis. The invisible hand pushes sellers into collective action.

The large number of self-regulatory approaches appears to be grounded in the recognition that there is an incentive and collective action problem with self-regulation. The concern about the inadequacy of self-regulation includes heterogeneity of the space that is being addressed. This leads to schemes that contemplate legislative mandates and the need for external monitoring and enforcement.

9. Of course the state plays a big role in creating the general conditions that make markets possible. *See* NORTH, *supra* note 15.

Alternative Types of Regulation

No regulation (Ofcom, 7)) Markets are able to deliver required outcomes. Citizens and consumers are empowered to take full advantage of the products and services and to avoid harm.

Self-regulation (Ofcom, 7) Industry collectively administers a solution to address citizen or consumer issues, or other regulatory objectives, without formal oversight from government or regulator. There are no explicit ex ante legal backstops in relation to rules agreed by the scheme (although general obligations may still apply to providers in this area).

- Pure Self-regulation (EMR 23)
- Stipulated Self-regulation (KLS 121)
- Robust, Enforceable Self-regulation (FTC)
- Enforced Self-regulation (EMR at 22)
- Coerced Self-regulation (EMR at 16)
- Mandated Self-regulation (R at 12)
- Social Self-regulation (GA 9)

Co-Regulation (Ofcom, 7) Schemes that involve elements of statutory regulation, with public authorities and industry collectively administering a solution to an identified issue. The split of responsibilities may vary, but typically government or regulators have legal backstop powers to secure desired objectives. (EMR)

Collaborative Regulation (EMR 15) The role and structure of the state are fundamentally transformed in a changing society. Governance is seen as a process of interaction between different social and political actors, and growing interdependencies between the two groups, as modern societies become ever more complex, dynamic, and diverse.

Reflexive Regulation (W 2) an entire infrastructure aimed at establishing… the right incentives for those bearing the costs of regulation; the right participatory structure for shaping the instruments so that all those affected have a voice in shaping them; the guarantee of legal certainty; and the possibility to hold actors accountable for the consequence of particular actions (GA 4)

Civic Regulation (GA 7, 11) The goal of civil regulation is to fill the vacuum left by the contracting state and to compensate for the "deficit of democratic governance that we face as a result of economic globalization… Under civic regulation, the various manifestations of civil society act in a variety of ways to influence corporations, consumers and markets…From civil regulation perspective, the state's role is to provide mechanisms that will empower the institutions of civil society to make corporations more accountable.

- Regulatory Pluralism ((GA at 10)
- Informational Regulation (GA 7)

Participatory Governance (GA 7) various manifestations of civil society act in a variety of ways to influence corporations, consumers and markets, often bypassing the state… However, the evolving role of civil regulation has not taken place entirely divorced from state intervention… a number of next generation policy instruments are geared to empower various institutions of civil society to play a more effective role in shaping business behavior.

TRADITIONAL, COMMAND AND CONTROL REGULATION

Statutory Regulation (GA at 4) Objectives and rules of engagement are defined by legislation, government or regulator, including the processes and specific requirements on companies with enforcement carried out by public authorities.

Formal (Ofcom 7)
Statutory (Ofcom, 7)
Notice and Comment (Ofcom)
Command and Control (EMR at 12, GA 2)
State Regulation (EMR at 16)

Sources and key:

B	**T.R . Burns, The Future of Parliamentary Democracy: Transition and Challenge in European Governance, Green Paper for the Conference of the Speakers of EU Parliaments, 22-24 September 2000, http://www.camera.it/_cppueg/ing/conferenza_odg_Conclusioni_gruppoesperti.asp**
EMR	**Hans Bredow Institute, Final Report: Study on Co-Regulation Measures in the Media Sector, University of Hamburg, June 2006http://ec.europa.eu/avpolicy/docs/library/studies/coregul/final_rep_en.pdf**
GA	**Neil Gunningham, Compliance, Enforcement and Innovation http://www.oecd.org/dataoecd/18/38/33947825.pdf**
GB	**Neil Gunningham, Regulatory Reform Beyond Command and Control, Earth System Governance: Theories and Strategies for Sustainability at the Amsterdam Conference on the Human Dimensions of Global Environmental Change, 24-26 May 2007http://www.2007amsterdamconference.org/Downloads/AC2007_Gunningham.pdf**
H	**Denis D. Hirsch, "The Law and Policy of Online Privacy: Regulation, Self-Regulation, or Co-Regulation, Theory Working Papers New York University School of Law http://lawpublications.seattleu.edu/cgi/viewcontent.cgi?article=2003&context=sulr**
kln	**Bert-Japp Koops, et al., Starting Point for ICT Regulation, B-J Koops, et. al (Eds.), Starting Points for ICT Regulation, ITER, The Hague, 2006http://rechten.uvt.nl/prints/upload/20066279084231203794 4.pdf**
OfCom	**Office of Communications, Identifying Appropriate Regulatory Solutions: Principles for Analysing Self- and Co-Regulation, 10-Dec-08http://stakeholders.ofcom.org.uk/consultations/coregulation/statement/**
R	**Ira S. Rubinsien, Privacy and Regulatory Innovation: Moving Beyond Voluntary Codes NELLCO Legal Scholarship Repositoryhttp://lsr.nellco.org/cgi/viewcontent.cgi?article=1181&context=nyu_plltwp**
SLK	**Laura Stein, et al., Civil Society, Participation in Multi-stakeholder Processes: in Between Realism and Utopia, LSE Research Online, 2009, http://eprints.lse.uk/27901**
W	**Sabine Weiland, Reflexive Governance — a Way Forward in Coordinated Natural Resource Policy?, REFGOV, Working paper series: REFGOV-GPS-19, draft versionhttp://refgov.cpdr.ucl.ac.be/?go=publications&cat=1&subcat=2**

TABLE VI-3: DESCRIBING ALTERNATIVE TYPES OF REGULATION

Once the state becomes involved, we are no longer in the realm of pure self-regulation. However, these days the literature offers up a series of concepts of self-regulation in which it is no longer "voluntary," but still is free from state command and control. These include enforced, coerced, stipulated, mandated, and social self-regulation. In some of these cases, the threat of state regulation is seen as the factor that motivates sellers to implement "self-regulation" to avoid having regulation imposed by the state. In other cases, the state requires the industry to self-regulate, but does not take part in framing or implementing the regulatory scheme.

Co-regulation receives a great deal of attention when the options on the table move beyond self-regulation. Note that all of the attention given to co-regulation is an affirmation that self-regulation is not deemed to be adequate. In co-regulation the state imposes the obligation to institute a regulatory scheme and retains backstop authority. The thrust of the argument is to back down reliance on the state and increase reliance on the industry. The Ofcom definition in Table VI-3 is indicative of the thrust of this approach to regulatory change. It envisions a trade-off between the role of the state and the role of the industry. State authority certifies the co-regulatory structure. The partnership is between the state and the industry. There is little or no mention of any change in the role of the public.

Thus, I view the existing discussion of change in regulation as involving a substantial reduction in the role of the state's command and control over market actors and actions with little, if any, contemplation of an increase in the role of the public. I consider the self- and co-regulation arguments in the literature as overwhelmingly about deregulation, not about regulatory reform. Advocates assert that there really is no need for regulation, but, if there are problems, the enlightened self-interest of producers will call forth

collective, voluntary, purely self-regulatory actions to solve the problem. If this does not happen, then the threat of regulation is posited as enough incentive to induce producers to engage in effective self-regulation. Failing that, the government could mandate or stipulate self-regulation, but should not directly regulate. However, the self-regulation experimental phase is never limited in time and the conditions that indicate failure are never specified; nor are the actions that would be taken if failure is admitted. Co-regulation introduces a dollop of state assertion of authority with little involvement of either the state or the public. Co-regulation is intended to address the failure of self-regulation (primarily the incentive and collective action problems) with the state acting as a backstop, but depending primarily on producers to act.

This seems to be a treadmill never intended to get to effective regulation, and a review of the literature supports such a view. The available contemporary alternative regulation literature can easily reinforce the concern of those who fear alternative regulation is a cover for weak regulation. The literature provides a severely disproportionate amount of attention to the ways in which alternative regulation gives greater deference and influence to the industry interests that are affected by regulation.

Fortunately, co-regulation does not exhaust the possibilities for approaches to regulation that reduce the role of the state, however. There is some discussion of increasing the role of other stakeholders in the regulatory process. Collaborative and reflexive regulations envision broader notions of involving and representing **all** stakeholders and interests in the regulatory process. Participatory governance and civic regulation focus on the participation of civil society groups.

VII. PARTICIPATORY GOVERNANCE

This section picks up on the public participation threads in the literature and weaves them into an alternative. It argues that the narrow focus on expanding the freedom and influence of producers is unjustified as a general proposition and counterproductive to the effort to respond to the quarter-life crisis. There is every reason to believe that the pubic (consumers) can benefit from and contribute to improved regulation as much as industry (producers), just as end-user innovation has enhanced the performance of many areas of the digital economy.[10] Balancing the approach may also reduce political tension. If regulatory approaches can be identified that are seen as effective but more flexible than traditional regulation, resistance may be reduced on both sides.

A. The Continuing Need for Good Governance

1. Conditions that Favor Oversight

With all these alternative forms of regulation available, it is natural to ask whether certain characteristics of or conditions in a sector point toward different forms of regulation as likely to be more successful or preferable. The regulatory reform literature provides the key link between the maturation challenges and the alternative forms of regulation, as shown in Table VII-1.

Replacement is the central concept. Replacement occurs "when people can no longer do things off-line but can only perform them online, the government should then create guarantees for accessibility."[11] The shift of activity online and the nature of that activity lay the basis for regulation. In the case of the

10. *See* ERIC VON HIPPEL, DEMOCRATIZING INNOVATION (2005), *available at* http://web.mit.edu/evhippel/www/democ1.htm.

11. *Report from the Commission on European Governance*, EUR. COMM'N (2003), http://ec.europa.eu/governance/docs/comm_rapport_en.pdf; EUROPEAN COMMISSION, DUTCH GUIDELINES FOR REGULATION EUROPEAN GOVERNANCE: White Paper, European Commission, *translated* in STARTING POINTS FOR ICT REGULATION: DECONSTRUCTING PREVALENT POLICY ONE-LINERS 133 (Bert-Jaap Koops et al. eds., 2006).

Internet, it is a combination of things that could not be done offline and things that can be done much more efficiently online that creates the urgency to provide access and ensure that the activities that took place in physical space are available in cyberspace.

Replacement/High Risk: "when people can no longer do things off-line but can only perform them online. The government should then create guarantees for accessibility."[1]

Fundamental Rights/Strong Public Interest Concerns: – "[Co-regulation] is only suited to cases where fundamental rights or major political choices are not called into question,[1] Self-regulation is not suitable if fundamental norms and values of democratic rule or law are at stake… this holds especially with respect to protecting classic human rights of citizens and preventing and investigating infringements of the rule of law and state security. In these cases, agreements between parties cannot suffice and legislation will be necessary."[2]

Industry Lack of incentives/organization: "We will establish whether the industry has a real incentive to resolve the issue, rather than just a publicly stated intention… where such incentives do not exist, a purely self-regulatory solution is less likely to succeed. But a form of co-regulation may be appropriate if weaknesses in incentives can be strengthened through statutory regulation… we should consider the incentives for members to cheat… and what monitoring and enforcement measures could be put in place for the scheme to be effective."[3]

Heterogeneity of Products: "We should therefore consider whether measurable objectives and simple rules can be established for the operation of the scheme. This include considering the complexity of the citizen and consumer objective, the diversity of the companies potentially taking part, the number and complexity of the service covered, and the availability of expertise in designing a solution." [3]

Instability of Technology/ Heterogeneity of Products: "if… stability is achieved. Then to promote legal certainty, perhaps codification of norms established by self-regulation could take place."[2] "[Self-regulation] should not be used where rules need to apply in a uniform way." [2]

Source: [1] Dutch Guidelines for Regulation [2] European Governance: White Paper, European Commission, cited in **Bert-Japp Koops, et al., Starting Point for ICT Regulation, B-J Koops, et. al (Eds.), Starting Points for ICT Regulation, ITER, The Hague, 2006http://rechten.uvt.nl/prints/upload/20066279084231203794 4.pdf, 133-136,[3] Office of Communications, Identifying Appropriate Regulatory Solutions: Principles for Analysing Self- and Co-Regulation, 10-Dec-08http://stakeholders.ofcom.org.uk/consultations/coregulation/statement/, 16.**

Table VII-1: Characteristics that Place Limits on Self/Co-Regulation

When the activities that have been replaced involve fundamental rights or important political activities are at issue, the need for regulation is greater. The list of fundamental rights and important activities includes human rights, the rule of law, and state security. These are prominent in several of the maturation challenges that the Internet faces.

Where the need for regulation might be met with self-regulation, other considerations can mitigate against it, if the activities are so important that they cannot be left to uncertain self-regulation. Finally, where technology has stabilized significantly and there is a need for uniformity, self-regulation may not be the preferred approach because it cannot produce the desired homogeneity. Complex goals, complex products and services delivered by diverse companies raise concerns about the ability of self-regulatory schemes to succeed.

2. The Ingredients of Successful Alternative Regulation

With an array of diverse problems and a large set of possible solutions, it is critical to have a clear idea of what successful alternative governance would look like. The literature provides clear insights (see Table VII-2). Even reviews that are friendly toward reducing reliance on traditional regulation recognize that key weaknesses of the alternatives must be addressed.

Transparency/Openness
- Clarity of Purpose
  - Dialogue
  - Consensus
  - Informing policy process
  - Influencing decisions
  - Planning
  - Implementation
  - Monitoring and evaluation
  - Data gathering and analysis
- Clarity of Process/Rules
  - Governance
  - Convening
  - Decision rules
    - Voting
      - Unanimity (Veto)
      - Super Majority
      - Majority
    - Non-Voting
      - Rough Consensus
    - Right of Appeal, Dissent
- Scope of "Authority"
  - Rules only
  - Review of operations & goals

Enforcement – Compliance
- Accountability
- Fairness
- Speed
- Appropriateness
- Complaint and Audit
- Adequacy of Resources

Participation
- Public Awareness
  - Rights - Redress
  - Public consultation
- Inclusiveness
  - Access
  - Representativeness
  - Organization of groups
  - Resources
  - Expertise
  - Role of independents
- Adequacy of Resources
  - Overall
  - For NGOs
- Industry Coverage
  - Achieve Critical Mass
  - Avoid "Capture" & Ballot packing

Legal Clarity
- Relationship to government
- Formal
  - Sponsored
  - Recognized
  - Status of Decisions
    - Safe Harbor
    - Reg.-Neg.
    - Sponsored
    - Recognized
    - Preferred
    - Advisory
- Informal
  - Bully Pulpit- Nudge
  - Procurement
  - R&D
- International

Desired Results
- External
  - Credibility
  - Legitimacy
  - Effectiveness
  - Efficiency
  - Adaptability
  - Flexibility
- Internal
  - Building Trust
  - Shared Knowledge & Expertise
  - Culture of Cooperation & Leadership

TABLE VII-2: ATTRIBUTES OF AN EFFECTIVE ALTERNATIVE REGULATION STRUCTURE[12]

The widely observed lack of openness and transparency points to a fundamental question of co-regulation as regards the scope of relevant stakeholders. Most of the systems do not include consumer or viewer/listener groups in a way, which provides for formal influence with the process of decision making. . . . While transparency is a generally accepted value of good regulation the openness to specific groups is a design feature of a co-regulatory system. How the interests are balanced defines the working of the system, its acceptance and legitima Even though the objective of regulatory reform is to reduce the role of the state, one of the key ingredients of success is political – the establishment of the legitimacy of the alternative regulatory process. Legitimacy is a quintessentially political concept that is accomplished by (1) designing internal structures and processes that are seen as participatory, transparent, and fair building trust, leadership, and skills among the participants and (2) achieving external results that are

12. HANS-BREDOW-INSTITUTE, *supra* note 125, at 118-23; European Governance, *supra* note 119, at 133-40; Bart Cammaerts, *Civil Society participation in multistakeholder processes: in between realism and utopia*, *in* MAKING OUR MEDIA: GLOBAL INITIATIVES TOWARD A DEMOCRATIC PUBLIC SPHERE 83 (Laura Stein, Dorothy Kidd, Clemencia Rodriguez eds., Hampton Press, 2009).

effective.

3. Expanding the Space for Alternative Governance

a. Constitutional and Collective Choice Decisions

The process by which the space for alternative governance can be expanded can be seen as a challenge in the realm of Constitutional and Collective Choice decision-making, as depicted in Figure VII-1, which uses the recommended principles of parliamentary reform discussed above.

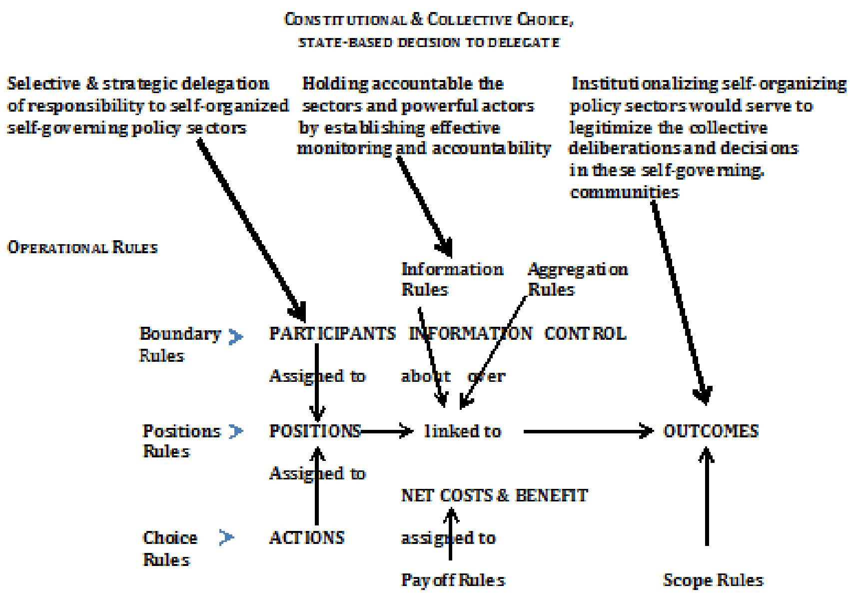


FIGURE VII-1: EXPANDING THE SPACE BETWEEN STATE AND MARKET

In building the legitimacy of alternative governance models in both the economy and the polity, the state has the important role of gracefully getting out of the way, while providing the important legal underpinning that makes significant contribution to the legitimacy of the alternative governance model. The state must provide legal clarity in selectively delegating more authority to autonomous, self-organizing policy sectors. Whether it chooses to delegate or regulate, it must reserve authority over areas where replacement has occurred and important values are at stake. In all cases, it is extremely important to seek to ensure that the institutions exhibit the key characteristics for successful oversight, including monitoring institutions for transparency, participation, and accountability.

The process of institutionalization discussed earlier is important. While it is clear that the state plays an important part in launching the authority of the alternative governance approach, over time, successful and effective alternatives build independent authority and trust. The ability of the state to revoke the authority shrinks. Eventually, any effort to rescind the authority becomes illegitimate.

b. Operational Framework for Participatory Governance

As described in Figure VII-2, participatory governance is envisioned as a multi-stakeholder process that involves industry, civil society, and technologists in both the writing and enforcement of rules. The ultimate goal is to foster compliance, rather than enforcement. The participants are the three sets of non-

governmental interests. The activities are rule writing and enforcement. It is supported by the state in the delegation decision.

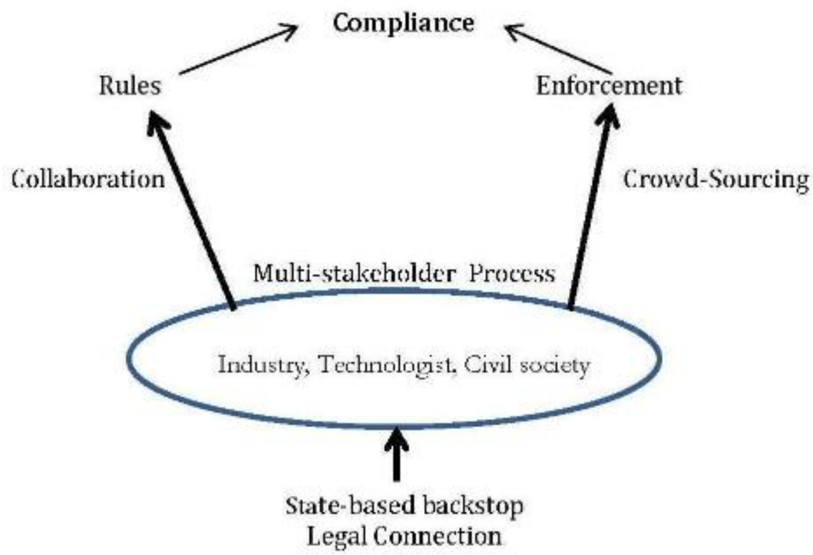


FIGURE VII-2: THE STRUCTURE OF PARTICIPATORY GOVERNANCE

We can envision two sets of possibilities, beginning with increasing activity that feeds into the regulatory process with the ultimate goal of shrinking the scope of regulatory process as the alternatives demonstrate their ability to do their job of governances (preserving the dynamic expansion of the Internet, while ensuring that the social goals are advanced).

Codes of conduct need to be developed by the multi-stakeholder process – not solely at the discretion of the industry. Codes of conduct that are developed through collaborative processes could be afforded special treatment by regulatory agencies and go into force on a fast track, but they need not be if self-regulatory enforcement and norms are strong enough. Enforcement of rules would open the door to crowd-sourcing enforcement in which the public participates directly. Complaints that are the result of the collaborative process could be granted special status and be handled in an expedited manner by the regulatory agency, or their enforcement could be through industry-based sanctions and processes.

In order to ensure that participatory governance attracts the participation necessary to make it effective and legitimate, it must fill the four voids left by the exit of the state (transparency, participation, legal clarity, and enforcement) and compensate for the failure of self-regulation. The right to appeal directly to the state would continue to exist, but the burden for success for complaints would be heavy for issues that had not been subjected to the participatory process. Complaints outside of the multi-stakeholder process cannot be prohibited, but they should bear a significantly heavier burden (a higher threshold and burden of proof). On the other hand, failure of businesses to participate should also come at a price, making complaints subject to accelerated consideration.

The most important ingredient is to ensure that the output of the new institutions is given a great deal of weight. This will provide an incentive to participate. The greater the authority of the intervening institutions, the more attention the structure should and will get. The multi-stakeholder group will have to be representative. Collaborative deliberation should be inclusive. In both cases, internal decision rules will have to be implemented (e.g., veto, super majority, majority, concurrence, and dissent).

The multi stakeholder processes would be subject to standards of representativeness, inclusiveness,

and participation, which are more explicit and likely to result in better representation than the current, inchoate approach that prevails in traditional regulation. Thus, the resulting structure will have a statutory core as the underlying legal foundation, but the bulk of the work of rule writing and enforcement will be transferred into the co-regulatory and participatory activities.

B. Enhancing the Democratic Process

Participatory governance can address many of the areas of concern about effective regulation. It can enhance public awareness, transparency, and independence of the regulatory structure by drawing members of the public and leaders of the public interest community into the process. Participatory governance also brings additional resources to enforcement, resources that are volunteered by the public in the form of participation, although the structure needs to provide additional resources for technical expertise.

The idea is to deepen democratic participation by building civil society institutions that fill the gap left by the traditional institutions of the polity. This idea has strong roots in democratic thinking in two highly developed aspects of democratic theory – the contemporary view of the public sphere and the traditional view of the press. I believe there are generally strong parallels between the two.

The unique role of the press as a civil society, public sphere institution that provides oversight over the polity and the economy has similarities to the role I envision for participatory governance. The above citations from the White Paper on representative democracy made this point directly. Elections are the primary form of participation in representative democracy that is no longer deemed sufficient for more knowledgeable, engaged publics. The press provides a primary oversight function of an engaged part of civil society.[13]

Democracy theorists and institution builders have believed for a quarter of a millennium that the press plays a central role in democracy by fulfilling two functions. The most prominent in their thinking was the role of the fourth estate to monitor and report on the other estates in society,[14] as shown in Table VII-3. However, in their prolific production of pamphlets they practiced the Fifth Estate function of mobilizing the populace to political action. The challenge with respect to participatory governance is to design structures that allow the Fifth Estate to compensate for the declining oversight functions of the state. Table VII-3 identifies the key functions of the press, which is defined as
non-governmental oversight. It plays both mediated (Fourth Estate) and direct mobilization (Fifth Estate) roles.[15]

---

13. NORTH, *supra* note 15, at 54-55.

14. *Fourth Estate,* WIKIPEDIA, http://en.wikipedia.org/wiki/Fourth_Estate (last modified Sept. 17, 2012, 19:44) ("The Fourth Estate (or *fourth estate*) is a societal or political force or institution whose influence is not consistently or officially recognized. "Fourth Estate" most commonly refers to the news media; especially print journalism or "The Press". Thomas Carlyle attributed the origin of the term to Edmund Burke, who used it in a parliamentary debate in 1787 on the opening up of Press reporting of the House of Commons of Great Britain. Earlier writers have applied the term to lawyers, to the British queens consort (acting as a free agent, independent of the king), and to the proletariat. The term makes implicit reference to the earlier division of the three Estates of the Realm. In current use the term is applied to the Press, with the earliest use in this sense described by Thomas Carlyle in his book *On Heroes and Hero Worship*: "Burke said there were Three Estates in Parliament; but, in the Reporters' Gallery yonder, there sat a Fourth Estate more important far than they all." In Burke's 1787 coining he would have been making reference to the traditional three estates of Parliament: The Lords Spiritual, the Lords Temporal and the Commons. If, indeed, Burke did make the statement Carlyle attributes to him, the remark may have been in the back of Carlyle's mind when he wrote in his *French Revolution* (1837) that "A Fourth Estate, of Able Editors, springs up; increases and multiplies, irrepressible, incalculable." In this context, the other three estates are those of the French States-General: the church, the nobility and the townsmen. Carlyle, however, may have mistaken his attribution . . . .").

15. C. EDWIN BAKER, MEDIA, MARKETS, AND DEMOCRACY 149, 151 (2002). ("Complex democracy seeks a political process that promotes both fair partisan bargaining and discourses aimed at agreement.") (also asserting the press should be pluralist, providing individuals and organized groups with information that indicates when their interests are at stake and help mobilize people to participate and promote their divergent interests, making policymakers aware of the content and strength of people's demands. The press should promote agreement on a society-wide common good, by being inclusive and promoting thoughtful discourse, not merely being factually informative, and supporting reflection and value or policy choice. The press should promote self-reflection, informing the public about itself, so that those who disagree with the dominant opinion can contest it and provide criteria to measure government responsiveness.).

Role	Relationship to the Public	Function	Complex Democracy's Ideal Media
Fourth Estate	Mediated	Monitorial	The Checking function Independent of both government and private economic power Grounded in the pluralism of the life world Nurture non-market structures to capture positive externalities
Fifth Estate	Direct	Participatory	Participatory Democracy's Ideal Media Pluralist: Distribute politically and culturally salient media in an egalitarian manner Supports interest group formation Mobilize interests Convey public opinion to policymakers Communal: promote agreement on common good Inclusive Thoughtfully discursive Self-Reflective Inform public about itself Contest dominant opinion Criterion to measure government responsiveness

TABLE VII-3: JOURNALISM AS A PARADIGM FOR NON-GOVERNMENTAL OVERSIGHT[16]

I refer to the Fifth Estate for ease of reference and because the concept is being applied to the impact of the Internet on the contemporary communications and media landscape. It captures the essence of the direct participatory role of the public. Dutton describes the Fifth Estate[17] as follows:

> More generally, the networks comprising the Fifth Estate have two key distinctive and important characteristics: 1. The ability to support institutions and individuals to enhance their 'communicative power' . . . by affording individuals opportunities to network within and beyond various institutional arenas. 2. The provision of capabilities that enable the creation of networks of individuals which have a public, social benefit (e.g. through social networking Web sites).[18]

The analogy between the press and participatory governance can be strengthened by locating these two institutions within the public sphere.[19] The public sphere mediates between the private sphere (which comprises civil society in the narrower sense, the realm of commodity exchange and of social labor) and the Sphere of Public Authority, which deals with the state. The public sphere crosses over both these realms. Through the vehicle of public opinion it puts the state in touch with the needs of society. This area is a site for the production and circulation of discourses, which can be critical of the state. These distinctions

16. *Id.* at 129-53.

17. My use of the term "5th estate" has similarities and differences with the use Dutton makes of the term. Dutton, *infra* note 129. I agree that the emergence of the 5th estate stems for the dramatic expansion of access to information and the ability to communicate across institutional and geographic boundaries. I disagree with the suggestion that the 5th estate can supplant the 4th estate without building structures that are intended to accomplish that purpose. Interestingly, the only other reference to the explicit use of the term 5th estate that Dutton makes is to a web site that adopted the name. The web site described itself as serious and satirical commentary and appears to be defunct (with no entry after July 2009). This example underscores the two characteristics of the 5th estate that distinguish it from the 4th estate. It is largely commentary and its durability over time at the level of individual organizations is suspect. Others have argued that the 5th estate is necessary to monitor the 4th estate. Ironically, if the 4th estate were doing a better job, the need for and role of the 5th estate in this regard would be reduced, but its broader role in democratic discourse would continue.

18. William H. Dutton, *The Fifth Estate Emerging Through the Network of Networks*, 27 PROMETHEUS 1, 3 (2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1167502.

19. Here I paraphrase the formulation offered in Wikipedia. Wikipedia is a perfect example of how the public sphere has expanded through the creation of new forms of mass communications. *See Public Sphere*, WIKIPEDIA, http://en.wikipedia.org/wiki/Public_sphere (last modified Sep. 5, 2012, 21:11).

between state apparatuses, economic markets, and democratic associations are essential to democratic theory. The study of the public sphere centers on the idea of participatory democracy and how public opinion becomes political action.

Figure VII-3 depicts a map of the media in a public sphere that has become much more complex and the make-up of the media much more diverse. The Figure is drawn to emphasize the fact that the growth has been in those areas of the media that are best suited to Fifth Estate functions. The challenge is to harness the Fifth Estate energy to accomplish the Fourth Estate oversight functions.

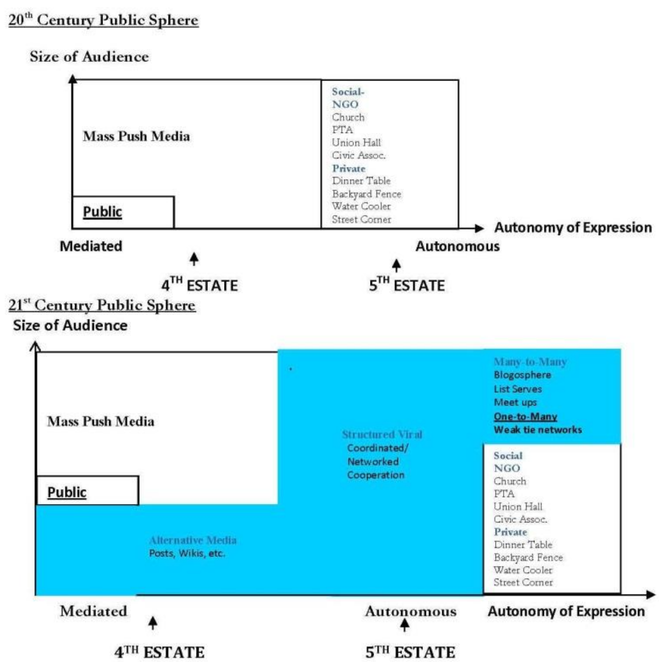


FIGURE VII -3: INCREASING DIVERSITY IN THE EXPANDING DIGITAL PUBLIC SPHERE

The Fifth Estate function is distinct from the Fourth Estate function, although it is generally hoped that monitoring society and informing the public will get them to act, but mobilizing is a different type of activity and the ability of Fourth Estate activity to mobilize people in the 20th century is debatable. The ability of unmediated viral communications to create strong collective action in the digital age has been widely noted.[20] Unmediated communications predominates in cyberspace because the medium is naturally suited to do this. There is a lively debate about whether the commercial mass media accomplished it function in the 20th century when commercialism overwhelmed journalism.[21] The goal of participatory governance is

20. *See, e.g.,* CLAY SHIRKY, HERE COMES EVERYBODY: THE POWER OF ORGANIZING WITHOUT ORGANIZATIONS, 2009; REBECCA MACKINNON, CONSENT OF THE GOVERNED: THE WORLDWIDE STRUGGLE FOR INTERNET FREEDOM, 2012.

21. BAKER, *supra* note 131, at 184, 187, 191 (The critique of 20th century journalism stems in large measure from the fact that its functions became obscured by its transformation into a commercial mass media enterprise.) ("[C]omplex democracy fears that the watchdog will be muzzled, whether by government or private power. . . .[M]onopolization or corrupted segmentation will suppress or disfigure media pluralism," because "[m]arket-determined segmentation predictably disfavors, for example, media focusing on political ideology, non-market-valued ethnic and cultural divisions, economically poorer groups . . . . When properly performing its various democratic functions, the media generates significant positive externalities – that is, benefits to people other than the immediate consumer of the product. The economic meaning . . . is that . . . free markets will under-produce these quality products.").

to expand the role of public sphere institutions as the state role shrinks. In the analogy to the press, I propose that participatory regulation can play a Fourth Estate function and infuse it with Fifth Estate energy.

B. Conclusion

Because the Internet and the digital networks on which it rides have become central institutions in societal and global communications and commerce, they can be described as "affected with a public interest."[22] The concept of public obligations falling on private enterprises is as old as capitalism itself.[23] While this term might strike fear into the hearts of some Internet stakeholders, because it evokes the specter of the utility-style common carrier regulation of the 20th century, the concept has a much longer and richer history that encompasses many forms of regulation that are much less intrusive.

While common carrier, public utility regulation was applied to certain large infrastructure industries over the course of the 20th century, many activities deemed to be affected with the public interest have been governed by criminal[24] and common law[25] (e.g., restaurants and other public places), prudential regulation (e.g., banks and insurance companies), or subject to self-regulation (e.g., professions like medicine and law).

On the one hand, it can be argued that in the 500-year history of the treatment of the public interest in capitalist society, command and control regulation is the exception, not the rule. On the other hand, it can also be argued that in the 500-year history of capitalism, the means of communications and transportation of commerce have always been regulated and have been required to shoulder unique responsibilities.

Thus the history of the concept of "affected with a public interest" argues for a careful consideration, not whether the Internet should shoulder new responsibilities, but how the obligations that the digital revolution must shoulder can be implemented in a way to preserve its dynamic nature. There is no reason to believe that one-size will fit all. In fact, the challenges have different causes and interact with the Internet ecology in different ways. Therefore, different institutional structures are likely to be better suited to meet specific challenges.

This analysis indicates that the successful model should not be asked to take on tasks for which it is not well suited. Internet governance involved highly technical issues that were debated primarily by technicians in an open format. The challenges that are primarily economic, social, and political will be difficult for the Internet institutions to deal with. The ability to separate technical from policy issues is sufficient to promote this balanced outcome. To a significant degree technology creates possibilities, while policies influence which paths are chosen. The perception of the nature of the challenges varies greatly

22. *Business Affected with a Public Interest*, THEFREEDICTIONARY.COM, *available at* http://legal-dictionary.thefreedictionary.com/Business+Affected+With+a+Public+Interest (last visited Sept. 12, 2012) ("A commercial venture or an occupation that has become subject to governmental regulation by virtue of its offering essential services or products to the community at large. A business affected with a public interest is subject to regulation by the Police Power of the state to protect and to promote the General Welfare of the community which it serves. Such a designation does not arise from the fact that the business is large, or that the public receives a benefit or enjoyment from its operation. The enterprise, as a result of its integral participation in the life of the community or by the privilege it has been granted by the state to serve the needs of the public, is regulated more strictly by the state than other businesses. What constitutes a business affected with a public interest varies from state to state. Three classes of businesses have been traditionally regarded as affected with a public interest: (1) those carried on pursuant to a public grant or privilege imposing a duty of making available essential services demanded by the public, such as common carriers and Public Utilities; (2) occupations considered from the earliest times in common law to be exceptional, such as the operation of inns or cabs; and (3) businesses that although not public at their inception have become such by devoting their activities to a public use, such as insurance companies and banks. A business affected with a public interest remains the property of its owner, but the community is considered to have such a stake in its operation that it becomes subject to public regulation to the extent of that interest.").

23. *See* James Speta, *A Common Carrier Approach to Internet Interconnection*, 54 FED. Comm. L.J. 225, 254 (2002).

24. *Criminal Law*, WIKIPEDIA, http://en.wikipedia.org/wiki/Criminal_law (last visited Sept. 11, 2012).

25. *Common Law*, WIKIPEDIA, http://en.wikipedia.org/wiki/Common_law (last modified Oct. 1, 2012, 17:15); *Civil Law (Common Law)*, WIKIPEDIA, http://en.wikipedia.org/wiki/Civil_law_(common_law) (last modified Oct. 1, 2012, 20:57).

across stakeholders and nations, with some seeing the functionalities technology provides as positive or negative, depending on the point of view of the stakeholder. In every area, technology has two sides, as noted above. For example,

- The ability to gather, store, and seamlessly transfer large quantities of information about consumers is seen as a threat to privacy by public interest advocates, while content owners and Internet companies see it as a positive way to fund and target the distribution of content and services.
- The ability to gather, store, and seamlessly transfer large quantities of perfectly replicable data is seen as a threat to intellectual property by content owners, who brand it as piracy, while public interest advocates see it as a major improvement in the ability of consumers to make fair use of content.
- The ability to monitor and prevent disruptive uses of the Internet is seen as an important tool to improve cyber security by some, or as a threat to freedom of speech, an invasion of privacy, or denial of freedom of assembly, by others.
- The winner-takes-most nature of digital markets that creates huge, dominant entities in many areas of the digital economy is seen as the efficient outcome by some and a major threat of abusive market power by others.

If we try to solve each of these important social policy challenges by tinkering with the basic structure of the resource system to impose changes, we run a very high risk of destroying its core structure (its communications protocols and governance institutions) and undermining its ability to function at the high level to which we have become accustomed. Responses to the maturation challenges should be crafted at the layer and in the realm in which they arise. Because the digital revolution has had such a profound and beneficial impact across all the realms of social order, reaching across layers and realms to solve problems is likely to have negative, unintended consequences. This is particularly true when the technology layer is involved.

The goal of a communications standard is to make activity possible. The more activity the standard supports, the better. The goal of policy is to direct activity in socially beneficial directions and dissuade socially harmful actions. The combination of successful self-regulation of the Internet and the light handed regulation of nondiscrimination on the telecommunications network was the bedrock of the digital revolution and produced decades of unparalleled innovation and growth in communications. They deserve a great deal of deference. Above all, those who would abandon the model or break the Internet altogether by abandoning its principles bear a heavy burden of proof. This applies to governments, network operators and civil society groups.

WHY GROWING UP IS HARD TO DO: INSTITUTIONAL CHALLENGES FOR INTERNET GOVERNANCE IN THE "QUARTER-LIFE CRISIS" OF THE DIGITAL REVOLUTION

MARK COOPER*

VI: GOVERNANCE INSTITUTIONS FOR THE DIGITAL REVOLUTION

A. Principles for Adaptation of Internet Governance

The combination of the weakness of the competing institutions (the market and the state) and the success of the Internet resource system suggests that enhancing the polycentric institution between the market and the state remains a viable, preferable approach to respond to the challenges. But, it is also clear that the existing institutions must adapt to meet the challenges. This section offers a series of principles for adapting Internet governances to the maturation challenges derived from the conceptual and empirical framework described earlier. It lays the foundation for the argument in the next section that "participatory governance" is a critically important institutional innovation needed to preserve and extend the success of the Internet resource system. It locates the concept in relation to the Internet governance debate, the broader crisis of legitimacy of the state, and the ongoing debate over regulatory reform.

1. Priorities for Preserving the Internet Principles by Expanding the Space of Governance Between Market and State

Meeting the challenge of "how we shift from 'government to governance' . . . relat[ing] traditional steering activities . . . with broader coordination tasks that . . . combine the multiple perspectives and needs of all institutional and noninstitutional Internet users"[1] requires an approach that

- recognizes the state will almost certainly be the origin of the fundamental steering choices, but
- ensures that it sets a course that preserves the Internet principles, while expanding the scope of autonomy between the market and the state.

I have argued that this was exactly the effect of the late 1960s Carterphone and Computer Inquiry proceedings and the decision to "unlicensed" some spectrum, so this is not an impossible task. Moreover, the understanding that this is the essential challenge permeates the Internet governance debate. The International documents discussed in Section III recognize the balance that must be struck between policy goals and the preservation of the dynamic Internet resource system. Table VI-1 adds to this body of evidence in a somewhat different way. It summarizes four analyses from the 2004-2005 period, which was a high point in the international debate over Interne governance because of the approach of the World Summit on the Information Society meeting in Tunis.[2] These are fairly comprehensive discussions that included explicit recommendations. They can be summarized in a small number of principles to guide the adaptation of the Internet governance substantive policymaking effort.

Structure and Units

1. To the greatest extent possible, preserve the end-to-end principle based on open, non-proprietary standards.
2. Recognize that markets have played a central role in deploying infrastructure and developing applications to drive Internet success, but

---

* *Journal on Telecommunications and High Technology Law,* 11:1 (2013).

1. PAVAN, *supra* note 19, at xxix.

2. *See World Summit on the Information Society*, WIKIPEDIA, http://en.wikipedia.org/wiki/World_Summit_on_the_Information_Society (last modified Aug. 18, 2012, 10:54 PM).

3. policy must also recognize that (a) the threats of scarcity and the exercise of market power require vigilant attention; (b) the political goal of the flow of information is not always synonymous with private or governmental interests; and (c) the social goal of universal service is not guaranteed by markets.

Users and Uses

4. Protect free flow of information, recognizing that both good and bad information may flow freely and states or private corporations are not always the best arbiters of which is which.
5. Promote the universal deployment of resources for development and the widest possible array of uses, which are the fundamental measure of success of the resource system.

Management and Governance

6. Apply a broad subsidiarity principle to policy, which means, in general, tasking institutions with responsibilities for which they are well-suited and, in particular, not burdening technical standards with socio-ecological policy responsibilities to the greatest extent possible.
7. Strengthen polycentric, inclusive, multi-stakeholder governance institutions.

MATURATION CHALLENGES[3]

2. The Multi-stakeholder Approach to Governance

a. Support for Multi-stakeholder Approaches in the Internet Space

One area where there has been considerable consensus at a high level of generalization in the Internet governance debate involves the institutional process for policymaking. For most of the issues raised, it is generally accepted that adaptation should flow from the existing institutions that have relied on multi-stakeholder principles. Where multi-stakeholder institutions are absent, they should be created. The observations on governance process of the three international groups identified in Section III are summarized in the top part of Table VI-2. The goals of participation, transparency, fairness, and data-based decision-making are endorsed with few countervailing concerns. Thus the conception of how multi-stakeholder processes should work is universally supported.

The bottom part of Table VI-2 reflects the magnitude of the challenge in another way. It shows the four sets of Internet stakeholders identified by the WGIG document. Each of the stakeholder groups corresponds fairly closely to one of the realms of social order. Moreover, the four sets of stakeholders have a great deal to do. The essential challenge for the multi-stakeholder process is to get the many different sets of stakeholders to collaborate to ensure that they all fulfill their long list of responsibilities.

3. Petru Dumitriu, *The World Summit on the Information Society (WSIS): From Geneva (2003) to Tunis (2005). A Diplomatic Perspective*, *in* MULTISTAKEHOLDER DIPLOMACY, CHALLENGES & OPPORTUNITIES 33 (Jovan Kurbalija & Valentin Katrandijev eds., 2006); Milton Mueller, John Mathiason & Lee W. McKnight, *Making Sense of "Internet Governance": Defining Principles and Norms in Policy Context*, *in* INTERNET GOVERNANCE: A GRAND COLLABORATION 100 (Don MacLean ed., 2004); William J. Drake, *Reframing Internet Governance Discourse: Fifteen Baseline Propositions*, *in* INTERNET GOVERNANCE: A GRAND COLLABORATION 122 (Don MacLean ed., 2004); *UNCTAD*, *supra* note 51.

Key to Sources: Petru Dumitriu, "The World Summit on the Information Society (WSIS): From Geneva (2003) to Tunis (2005). A Diplomatic Perspective, "**in** J. Kubalija and V. Katundjun (Eds.) Multistakeholder Diplomacy, Challengers & Opportunities (2006); **Milton Mueller, John Mathiason and Lee W. McKnight, "Making Sense of 'Internet Governance': Defining Principles and Norms in Policy Context in Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004);** *William Drake, Reframing Internet Governance Discourse: Fifteen Baseline Propositions, In Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004);* United Nations Conference on Trade and Development (UNCTAD), "Internet Governance," in Don MacLean (Ed.) Internet Governance: A Grand Collaboration (United Nations ICT Task Force, 2004).

PRINCIPLES	**PURPOSES**
Structure & Units	
The global commons	**The Internet is based on global open, and non-proprietary standards. They are published and accessible to anyone without payment of fees.**

POLICY RECOMMENDATIONS: We need to keep those doors open. Nevertheless, maximum caution is necessary when attempting to privatize essential commons. **Do not allow the commons to be privatized.**

End-to-End Principle	**Architectural principle creates an interoperable, neutral, transparent platform supporting a wide variety of applications and services**

POLICY RECOMMENDATIONS: Preserve the technical standard Management of resources should not be overloaded with policy… Resource allocation should be consistent with the end - to-end principle… Regulation of the fraudulent and criminal activity must be directed at responsible endpoints, not at the internetworking process itself. In all these cases, the substantive character of the issue at hand, rather than the fact that the Internet is the medium through which the problematic activity is conducted, should be the determining criterion as to what level of "governance" (from consensus building and cooperation to rule-making) and what instruments should be applied.

Inclusiveness	**The Internet has been driven "from the bottom up"**

POLICY RECOMMENDATIONS: This feature could be enhanced by consolidating or by building from scratch governance structures that are genuinely open and inclusive of governments. *The effective inclusion of developing countries requires much greater attention…. Greater attention is needed to the inclusion of civil society organizations, small and medium-sized enterprises and individual users.* First, it must be recognized that whatever the merits of the case for their reform, the loose constellation of organizations that have so far underpinned the development of the Internet have achieved remarkable success in ensuring the stability and unit of a highly decentralized network of networks with no centre and not strong rule-making authority… In order for any reform proposal to be viable, not just technically but also politically, it must provide strong evidence that it will ensure the continued stability and quality of service of the Internet, prevent its fragmentation and maintain the "bottom-Up" processes through which standards and policies have been developed so far. *Technical and policy issues often cannot be neatly separated*

Private Market	**Fosters decentralized, small scale investment and variation in approach**

POLICY RECOMMENDATIONS: Do not transform standards commons into a basis for regulating the private market. *With respect to the substance of rule systems, efficiency means devising frameworks that do not inhibit technological change, unduly constrain the development of markets, or make it difficult for governments and stakeholder to reach agreements.* No one size fits all solutions are likely to emerge… a number of questions in which technological and policy issues are particularly intertwined are likely to be best treated within a network of international frameworks (as opposed to a unified, structured organization) of cooperation and coordination for the development of the Internet… In such a cooperative framework flexibility should be a paramount consideration… Structural flexibility and lightness are also needed in order to prevent governance solutions from being rendered obsolete by technological evolution.

Functionality/ and *Congruence*	**The Internet… development actually started from the need to perform a function.**

POLICY RECOMMENDATIONS: If we decide to use the Internet as a tool for achieving social development objectives, the governance model we follow should not be meant only to monitor, to restrict and to regulate. We need to allow and enhance functionality by representing and adequately using a balance of interests, capabilities and needs that exist in exist in real life. *Efficiency concerns suggest that form should follow function to the extent possible… In general terms, it is desirable to optimize institutional forms so that they match the issues to be managed. This overarching concern applies to both the substantive rules and institutional procedures in governance mechanisms.* [E]volution is more likely to produce results than a voluntarist top down approach. The current system of management of core Internet resources is the result of a process that has taken place over a remarkably short time. It is clear that this evolution has not yet reached a stage of maturity that is acceptable to all stakeholders. It must also complete a process of genuine internationalization (which is not necessarily equivalent to full-fledged intergovernmentalization, but which implies representatively requirements beyond the participation of individuals/organizations of various nationalities. In doing so it is essential to reconcile demands for change with the need to ensure continued delivery of the critical services.

<u>Users and Uses</u>

Moral Neutrality **Self-reliance**	**Transparency, speed and accessibility of information and content and services. But this communications enabling power applies to "bad ""as well as "good" information communications behavior.**

POLICY RECOMMENDATIONS: Private networks or users can build electronic "fences" or adopt filters or practices that can, to some extent, shelter themselves from undesirable forms of while maintaining some form of compatibility and interconnection with the rest of the world. Whereas and traditional notions of government and governance imply uniformity, Internet permits variation in policies adopted in response to the same problem.

Resource scarcity, Scale and dependence increase value of control concentration, & control

POLCY RECOMMENDATIONS: Concentration and control raise legitimate grounds to investigate bottlenecks and the economic and political impact of legacy control. *Equity concerns are equally important and will become more so as the Internet becomes increasingly pervasive and thus affects a wider range of social interests.... What about situations... where concentrated market structures allow powerful firms to in effect set generally applied rules via their business strategies, rather than through collaborative decision making?*

Internet for development Infrastructure development should be decentralized and competitive

POLICY RECOMMENDATIONS: In order to help governments reach their economic and social aims, one should not look for methods to control the Internet, but for means to use its comparative advantage and prevent ICTs from becoming a factor that broadens, Instead of narrows, divides... We need to turn the technological advances into economic and social benefits; to attach societal assets to technological virtues, and to explore potential that have been unchartered. **Digital divide subsidies, if there are to be any, should go to end users and not to centralized suppliers or governments. Providing resources to end users...to acquire those elements of end user infrastructure should serve to stimulate and encourage development while maintaining a maximum degree of choice and diversity in supply.**

<u>Governance</u>

Polycentric **Multi-stakeholder**	**Distributed and multifarious, cannot be regulated in a top down manner** *Internet governance involves a heterogeneous array of formalized public and private sector rules that vary widely in their institutional attributes. Entails a heterogeneous and highly distributed array of prescriptions and processes that reflects the Internet's core features rather than centralized "one size fits all" control over a single system.* Spontaneous expression of the consensus and discipline of the main players on the use of standards and protocols

POLICY RECOMMENDATIONS: Multistakeholder governance should be encouraged government, private business, civil society and international organizations. If we replace the naturally normative work that has been emerging spontaneously with more systematic work, we need a common understanding of what should be expected from the parties involved. After defining those contours of governance, we may gradually move toward agreement on rules, decision-making procedures, and institutions. *Viewing these governance mechanisms in an integrative manner would allow us to evaluate the full diversity of public and private sector practices that help to shape bot the infrastructure and transactions and content, to systematically assess what works... and to consider whether there are any holes, tensions or cross- cutting issues... [I]f properly structured, it could well build a stronger global consensus that would underpin the Internet's continuing growth as an open and vibrant medium.* <u>A sustained effort of capacity building for Internet policy making is needed so that the majority of the developing countries can effectively participate in the management/governance systems.</u>

Specialization	Inclusion does not rule out specialization as a prerequisite for efficiency and effectiveness.

POLICY RECOMMENDATIONS: Internet governance should count on specialization. The separate and complementary functions of public and private governance structures, the legitimate roles of different actors, and the need to create organic and as building blocks.

Self-restraint Accountability	The highly technical nature of the work on standards and protocols does not imply ignoring social consequences.

POLICY RECOMMENDATIONS: While accepting the need for more governance, it is equally important for public policy to refrain from regulating what does not need to be regulated. Normal democratic procedures... will inevitably be slow in an environment of rapid change and technological development. Governments should be knowledgeable about prospects in the technical field. The same conclusion is valid for national policies and laws of the powerful countries when they set rules that affect the global community. *If they are not designed to maximize efficiency and flexibility, they may not be functionally effective or politically sustainable.* <u>Of course, it is not possible to establish a clear-cut separation between all infrastructural/technical matters on the one side and political and socio-economic questions on the other. Policy decisions very often have technological implications and vice versa. A crude device to categorize public policy issue that need to be addressed and the responses that could be explored in each case could be to distinguish between the management of the Internet as a global utility and the international governance issues posed by the use people make of the utility.</u>

TABLE VI-1: FOUNDATIONS OF INTERNET SUCCESS AND RECOMMENDATIONS FOR RESPONDING TO THE

Purposes and Principles

Working Group on Policy Making	OECD Principles for Internet Governance	UNESCO Code of Ethics
Meaningful participation in global policy Multi-stakeholder forum to address Internet-related policy issues Functions: Audit, Arbitration, Coordination Regulation Structure: multilateral, transparent Ensure transparency, fair process, and accountability democratic inclusive: governments, private sector, civil society, Regional, national International coordination, International Orgs.	Encourage multi-stakeholder co- development operation in policy development processes: Foster voluntarily developed codes of conduct Develop capacities to bring publicly available, reliable, data into the policy-making process: Limit intermediary liability Give appropriate priority to enforcement efforts	Member states are responsible for ensuring an an inclusive, relevant, up-to-date and legal environment for the development of the information society

Sources: OECD, *Communiqué on Principles for Internet Policy-Making*, OECD High Level Meeting, The Internet Economy: Generating Innovation and Growth, Paris, June 28-29, 2011; *Report of the Working Group on Internet Governance*, Chateau de Bossey, June 2005.

Internet Stakeholder Groups and Responsibilities

Governments (Polity)
Public policymaking and coordination and implementation, as appropriate, at the national level, and policy development and coordination at the regional and international levels.
Creating an enabling environment for information and communication technology (ICT) development.
Oversight functions.
Development and adoption of laws, regulations and standards.
Treaty-making.
Development of best practices.
Fostering capacity-building in and through ICTs.
Promoting research and development of technologies and standards.
Promoting access to ICT services.
Combating cybercrime.
Fostering international and regional cooperation.
Promoting the development of infrastructure and ICT applications.
Addressing general developmental issues.
Promoting multilingualism and cultural diversity.
Dispute resolution and arbitration.

Civil society (Socio-cultural)
Awareness-raising and capacity-building (knowledge, training, skills sharing).
Promoting various public interest objectives.
Facilitating network-building.
Mobilizing citizens in democratic processes.
Bringing perspectives of marginalized groups, including, for example, excluded communities and grass-roots activists.
Engaging in policy processes.
Contributing expertise, skills, experience and knowledge in a range of ICT policy areas.
Contributing to policy processes and policies that are more bottom-up, people-centred and inclusive.
Research and development of technologies and standards.
Development and dissemination of best practices.
Helping to ensure that political and market forces are accountable to the needs of all members of society.
Encouraging social responsibility and good governance practice.
Advocating for the development of social projects and activities that are critical but may not be "fashionable" or profitable.
Contributing to shaping visions of human-centred information societies based on human rights, sustainable development, social justice and empowerment.

The private sector (Economy)
Industry self-regulation.
Development of best practices.
Development of policy proposals, guidelines and tools for policymakers and other stakeholders.
Research and development of technologies, standards and processes.
Contribution to the drafting of national law and participation in national and international policy development.
Fostering innovation.
Arbitration and dispute resolution.
Promoting capacity-building.

Academic/technical Community (Technology).
The contribution to the Internet of the academic community is very valuable and constitutes one of its main sources of inspiration, innovation and creativity.
Similarly, the technical community and its organizations are deeply involved in Internet operation, Internet standard-setting and Internet services development.
Both of these groups make a permanent and valuable contribution to the stability, security, functioning and evolution of the Internet. They interact extensively with and within all stakeholder groups.

Source: Report of the Working Group on Internet Governance, Chateau de Bossey, June 2005

TABLE VI-2: PRINCIPLES AND STAKEHOLDERS FOR INTERNET GOVERNANCE

b. Broader Challenges of Legitimacy

The interest in a multi-stakeholder approach is not only consistent with the organic Internet governance institution,[4] it also responds to the perceived decline in the legitimacy of the state. An EU White Paper from 2003 on parliamentary democracy notes the challenge of maintaining the connection between representative political institutions and the public as the information age progresses.

> Parliamentary territorial representation entails the involvement of a select few in law- and policy-making and provides a reliable basis for well-organized deliberation and decision-making. It enables in many cases more or less effective and reliable legislative action judged to be legitimate. Of course, such arrangements risk a de-coupling between Parliament and "the people." Two institutional arrangements were supposed to limit such de-coupling, namely regular parliamentary elections and a free press. But, as suggested in this [p]aper, much more is needed. Modern citizenry does not consist of a homogeneous mass public, or merely supporters of one or more parties. They are increasingly complex in their judgments and engagements. They make up an ensemble of publics and differentiated interests and competencies.[5]

Thus, the fundamental challenge in the economy of preserving a dynamic diverse product space in which consumers play a more active role has a direct parallel in the polity. A diverse, knowledgeable citizenry that wants to be and is engaged in the policy process challenges the incumbent institutions. It can be argued that the Internet is ahead of the polity in that it has provided a partial solution that took this

4. *See* Mueller, *supra* note 19, at 217 (calling them "Organically Developed Internet Institutions.").

5. T.R. Burns, *The Future of Parliamentary Democracy: Transition and Challenge in European Governance*, green paper for the *Conference of the Speakers of European Union Parliaments*, CAMERA DEI DEPUTATI (IT.)(Sept. 22-24, 2000). http://www.camera.it/_cppueg/ing/conferenza_odg_Conclusioni_gruppoesperti.asp.

direction, but it should also be recognized that the framework for promoting and channeling civil society engagement to build a legitimate and effective set of institutions is a work in progress.

The key to achieving the goal of enhancing democratization identified in the White Paper is that as the state recedes; it must use the remaining "legal connection" to promote participatory governance to ensure a larger direct role for the public. The principles of parliamentary reform offered as a response to this growing democratic deficit can be applied broadly to governance.

> [W]e suggest consideration of reforms of parliamentary functions, role, and institutional arrangements guided by principles such as the following:
>
> The principle of exercising high selectivity – with respect to the policy areas in which Parliament engages itself directly, for example in the formulation of specific or detailed laws and policies. This calls for explicit consideration of the reasons for such focused involvement.
>
> The principle to delegate whenever possible – a form of subsidiarity principle – to self-organizing policy sectors, at the same time holding accountable these sectors or key or powerful actors in these sectors. Part of this entails establishing effective monitoring and accounting arrangements.
>
> Institutionalizing these self-organizing policy sectors would serve also to legitimize the collective deliberations and decisions in these self-governing communities.
>
> The principle of focusing on strategic problems and issues that cannot be readily delegated or dealt with through private interests or civil society . . . .[6]

This is a road map for transferring active decision-making from the state to civil society. It is consistent with Ostrom's observations on the nesting of governance of resource systems in complex environments.

> Given the wide variety of ecological problems that individuals face at diverse scales, an important design principle is getting the boundaries of any one system roughly to fit the ecological boundaries of the problem it is designed to address. Since most ecological problems are nested from very small local ecologies to those of global proportions, following this principle requires a substantial investment in governance systems at multiple levels—each with some autonomy but each exposed to information, sanctioning, and actions from below and above.[7]

3. The Many Flavors of Alternative Governance

Reflecting the central theme of increasing direct participation in governance, Figure VI-1 arrays the various approaches to governance along two dimensions—the extent of state involvement and the extent of public involvement. I use the term "alternative governance" because a number of adjectives have been used to describe both the substance and process of regulatory change.[8] At the origin, the role of the industry is dominant. Along the X-axis the role of the state increases. Along the Y-axis the role of civil society increases.

---

6. *Id.* (bullet points removed).
7. OSTROM, *supra* note 31, at 258 (citations omitted).
8. Much of the argument for alternative regulation has its origin in the experience of environmental regulation, but the concept has spread to the information, communications and media sectors. *See* Neil Gunningham, *Compliance, Enforcement and Innovation*, ORG. ECON. CO-OPERATION & DEV. (2004), http://www.oecd.org/environment/environmentinemergingandtransitioneconomies/33947825.pdf; Neil Gunningham, *Regulatory Reform Beyond Command and Control*, AMSTERDAM CONF. ON THE HUM. DIMENSIONS GLOBAL ENVTL. CHANGE (May 26-27, 2007), http://www.2007amsterdamconference.org/Downloads/AC2007_Gunningham.pdf.

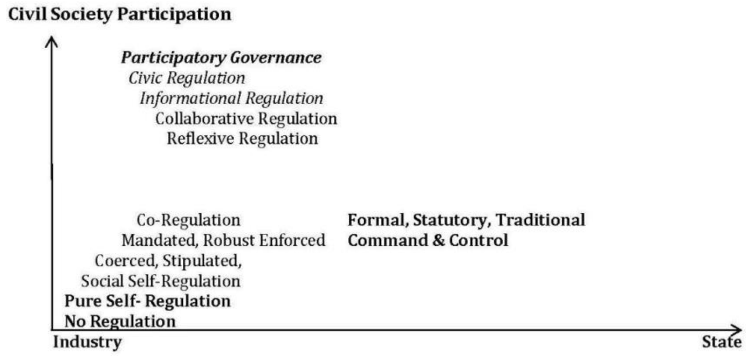


FIGURE VI-1: THE GROWING STOCK OF REGULATORY APPROACHES

Table VI-3 provides definitions for the various types of regulation that have been discussed in the literature. They are listed in order running from least to most regulatory, as I understand the thrust of the underlying concepts.

There are two polar opposites identified in this approach – "no regulation" is the least regulatory and traditional regulation the most. No regulation is the condition in which the transaction is not governed by direct involvement of the state or any explicit regulatory mechanism. Rather, the invisible hand of the market is presumed to ensure socially desirable outcomes.[9] At the opposite extreme, traditional, formal, statutory regulation occurs where the state (through its representative institutions) sets the goals and empowers the administrative apparatus of the state to write, implement, and enforce rules. Between the polar opposites, we have long had a number of mixed approaches and the number has been growing in the past two decades. Pure self-regulation occurs where the sellers in the market band together to produce rules to discipline the behavior of sellers in the market, presumably to promote the common interest of the sellers. In the case of pure self-regulation, sellers adopt the institution of regulation on a purely voluntary basis. The invisible hand pushes sellers into collective action.

The large number of self-regulatory approaches appears to be grounded in the recognition that there is an incentive and collective action problem with self-regulation. The concern about the inadequacy of self-regulation includes heterogeneity of the space that is being addressed. This leads to schemes that contemplate legislative mandates and the need for external monitoring and enforcement.

9. Of course the state plays a big role in creating the general conditions that make markets possible. *See* NORTH, *supra* note 15.

Alternative Types of Regulation

No regulation (Ofcom, 7)) Markets are able to deliver required outcomes. Citizens and consumers are empowered to take full advantage of the products and services and to avoid harm.

Self-regulation (Ofcom, 7) Industry collectively administers a solution to address citizen or consumer issues, or other regulatory objectives, without formal oversight from government or regulator. There are no explicit ex ante legal backstops in relation to rules agreed by the scheme (although general obligations may still apply to providers in this area).

Pure Self-regulation (EMR 23)
Stipulated Self-regulation (KLS 121)
Robust, Enforceable Self-regulation (FTC)
Enforced Self-regulation (EMR at 22)
Coerced Self-regulation (EMR at 16)
Mandated Self-regulation (R at 12)
Social Self-regulation (GA 9)

Co-Regulation (Ofcom, 7) Schemes that involve elements of statutory regulation, with public authorities and industry collectively administering a solution to an identified issue. The split of responsibilities may vary, but typically government or regulators have legal backstop powers to secure desired objectives. (EMR)

Collaborative Regulation (EMR 15) The role and structure of the state are fundamentally transformed in a changing society. Governance is seen as a process of interaction between different social and political actors, and growing interdependencies between the two groups, as modern societies become ever more complex, dynamic, and diverse.

Reflexive Regulation (W 2) an entire infrastructure aimed at establishing… the right incentives for those bearing the costs of regulation; the right participatory structure for shaping the instruments so that all those affected have a voice in shaping them; the guarantee of legal certainty; and the possibility to hold actors accountable for the consequence of particular actions (GA 4)

Civic Regulation (GA 7, 11) The goal of civil regulation is to fill the vacuum left by the contracting state and to compensate for the "deficit of democratic governance that we face as a result of economic globalization… Under civic regulation, the various manifestations of civil society act in a variety of ways to influence corporations, consumers and markets…From civil regulation perspective, the state's role is to provide mechanisms that will empower the institutions of civil society to make corporations more accountable.

Regulatory Pluralism ((GA at 10)
Informational Regulation (GA 7)

Participatory Governance (GA 7) various manifestations of civil society act in a variety of ways to influence corporations, consumers and markets, often bypassing the state… However, the evolving role of civil regulation has not taken place entirely divorced from state intervention… a number of next generation policy instruments are geared to empower various institutions of civil society to play a more effective role in shaping business behavior.

TRADITIONAL, COMMAND AND CONTROL REGULATION

Statutory Regulation (GA at 4) Objectives and rules of engagement are defined by legislation, government or regulator, including the processes and specific requirements on companies with enforcement carried out by public authorities.

Formal (Ofcom 7)
Statutory (Ofcom, 7)
Notice and Comment (Ofcom)
Command and Control (EMR at 12, GA 2)
State Regulation (EMR at 16)

Sources and key:

B	**T.R . Burns, The Future of Parliamentary Democracy: Transition and Challenge in European Governance, Green Paper for the Conference of the Speakers of EU Parliaments, 22-24 September 2000, http://www.camera.it/_cppueg/ing/conferenza_odg_Conclusioni_gruppoesperti.asp**
EMR	**Hans Bredow Institute, Final Report: Study on Co-Regulation Measures in the Media Sector, University of Hamburg, June 2006http://ec.europa.eu/avpolicy/docs/library/studies/coregul/final_rep_en.pdf**
GA	**Neil Gunningham, Compliance, Enforcement and Innovation http://www.oecd.org/dataoecd/18/38/33947825.pdf**
GB	**Neil Gunningham, Regulatory Reform Beyond Command and Control, Earth System Governance: Theories and Strategies for Sustainability at the Amsterdam Conference on the Human Dimensions of Global Environmental Change, 24-26 May 2007http://www.2007amsterdamconference.org/Downloads/AC2007_Gunningham.pdf**
H	**Denis D. Hirsch, "The Law and Policy of Online Privacy: Regulation, Self-Regulation, or Co-Regulation, Theory Working Papers New York University School of Law http://lawpublications.seattleu.edu/cgi/viewcontent.cgi?article=2003&context=sulr**
kln	**Bert-Japp Koops, et al., Starting Point for ICT Regulation, B-J Koops, et. al (Eds.), Starting Points for ICT Regulation, ITER, The Hague, 2006http://rechten.uvt.nl/prints/upload/200662790842312037944.pdf**
OfCom	**Office of Communications, Identifying Appropriate Regulatory Solutions: Principles for Analysing Self- and Co-Regulation, 10-Dec-08http://stakeholders.ofcom.org.uk/consultations/coregulation/statement/**
R	**Ira S. Rubinsien, Privacy and Regulatory Innovation: Moving Beyond Voluntary Codes NELLCO Legal Scholarship Repositoryhttp://lsr.nellco.org/cgi/viewcontent.cgi?article=1181&context=nyu_plltwp**
SLK	**Laura Stein, et al., Civil Society, Participation in Multi-stakeholder Processes: in Between Realism and Utopia, LSE Research Online, 2009, http://eprints.lse.uk/27901**
W	**Sabine Weiland, Reflexive Governance — a Way Forward in Coordinated Natural Resource Policy?, REFGOV, Working paper series: REFGOV-GPS-19, draft versionhttp://refgov.cpdr.ucl.ac.be/?go=publications&cat=1&subcat=2**

TABLE VI-3: DESCRIBING ALTERNATIVE TYPES OF REGULATION

Once the state becomes involved, we are no longer in the realm of pure self-regulation. However, these days the literature offers up a series of concepts of self-regulation in which it is no longer "voluntary," but still is free from state command and control. These include enforced, coerced, stipulated, mandated, and social self-regulation. In some of these cases, the threat of state regulation is seen as the factor that motivates sellers to implement "self-regulation" to avoid having regulation imposed by the state. In other cases, the state requires the industry to self-regulate, but does not take part in framing or implementing the regulatory scheme.

Co-regulation receives a great deal of attention when the options on the table move beyond self-regulation. Note that all of the attention given to co-regulation is an affirmation that self-regulation is not deemed to be adequate. In co-regulation the state imposes the obligation to institute a regulatory scheme and retains backstop authority. The thrust of the argument is to back down reliance on the state and increase reliance on the industry. The Ofcom definition in Table VI-3 is indicative of the thrust of this approach to regulatory change. It envisions a trade-off between the role of the state and the role of the industry. State authority certifies the co-regulatory structure. The partnership is between the state and the industry. There is little or no mention of any change in the role of the public.

Thus, I view the existing discussion of change in regulation as involving a substantial reduction in the role of the state's command and control over market actors and actions with little, if any, contemplation of an increase in the role of the public. I consider the self- and co-regulation arguments in the literature as overwhelmingly about deregulation, not about regulatory reform. Advocates assert that there really is no need for regulation, but, if there are problems, the enlightened self-interest of producers will call forth

collective, voluntary, purely self-regulatory actions to solve the problem. If this does not happen, then the threat of regulation is posited as enough incentive to induce producers to engage in effective self-regulation. Failing that, the government could mandate or stipulate self-regulation, but should not directly regulate. However, the self-regulation experimental phase is never limited in time and the conditions that indicate failure are never specified; nor are the actions that would be taken if failure is admitted. Co-regulation introduces a dollop of state assertion of authority with little involvement of either the state or the public. Co-regulation is intended to address the failure of self-regulation (primarily the incentive and collective action problems) with the state acting as a backstop, but depending primarily on producers to act.

This seems to be a treadmill never intended to get to effective regulation, and a review of the literature supports such a view. The available contemporary alternative regulation literature can easily reinforce the concern of those who fear alternative regulation is a cover for weak regulation. The literature provides a severely disproportionate amount of attention to the ways in which alternative regulation gives greater deference and influence to the industry interests that are affected by regulation.

Fortunately, co-regulation does not exhaust the possibilities for approaches to regulation that reduce the role of the state, however. There is some discussion of increasing the role of other stakeholders in the regulatory process. Collaborative and reflexive regulations envision broader notions of involving and representing **all** stakeholders and interests in the regulatory process. Participatory governance and civic regulation focus on the participation of civil society groups.

VII. PARTICIPATORY GOVERNANCE

This section picks up on the public participation threads in the literature and weaves them into an alternative. It argues that the narrow focus on expanding the freedom and influence of producers is unjustified as a general proposition and counterproductive to the effort to respond to the quarter-life crisis. There is every reason to believe that the pubic (consumers) can benefit from and contribute to improved regulation as much as industry (producers), just as end-user innovation has enhanced the performance of many areas of the digital economy.[10] Balancing the approach may also reduce political tension. If regulatory approaches can be identified that are seen as effective but more flexible than traditional regulation, resistance may be reduced on both sides.

A. The Continuing Need for Good Governance

1. Conditions that Favor Oversight

With all these alternative forms of regulation available, it is natural to ask whether certain characteristics of or conditions in a sector point toward different forms of regulation as likely to be more successful or preferable. The regulatory reform literature provides the key link between the maturation challenges and the alternative forms of regulation, as shown in Table VII-1.

Replacement is the central concept. Replacement occurs "when people can no longer do things off-line but can only perform them online, the government should then create guarantees for accessibility."[11] The shift of activity online and the nature of that activity lay the basis for regulation. In the case of the

10. *See* ERIC VON HIPPEL, DEMOCRATIZING INNOVATION (2005), *available at* http://web.mit.edu/evhippel/www/democ1.htm.

11. *Report from the Commission on European Governance*, EUR. COMM'N (2003), http://ec.europa.eu/governance/docs/comm_rapport_en.pdf; EUROPEAN COMMISSION, DUTCH GUIDELINES FOR REGULATION EUROPEAN GOVERNANCE: White Paper, European Commission, *translated* in STARTING POINTS FOR ICT REGULATION: DECONSTRUCTING PREVALENT POLICY ONE-LINERS 133 (Bert-Jaap Koops et al. eds., 2006).

Internet, it is a combination of things that could not be done offline and things that can be done much more efficiently online that creates the urgency to provide access and ensure that the activities that took place in physical space are available in cyberspace.

Replacement/High Risk: "when people can no longer do things off-line but can only perform them online. The government should then create guarantees for accessibility."[1]

Fundamental Rights/Strong Public Interest Concerns: – "[Co-regulation] is only suited to cases where fundamental rights or major political choices are not called into question,[1] Self-regulation is not suitable if fundamental norms and values of democratic rule or law are at stake… this holds especially with respect to protecting classic human rights of citizens and preventing and investigating infringements of the rule of law and state security. In these cases, agreements between parties cannot suffice and legislation will be necessary."[2]

Industry Lack of incentives/organization: "We will establish whether the industry has a real incentive to resolve the issue, rather than just a publicly stated intention… where such incentives do not exist, a purely self-regulatory solution is less likely to succeed. But a form of co-regulation may be appropriate if weaknesses in incentives can be strengthened through statutory regulation… we should consider the incentives for members to cheat… and what monitoring and enforcement measures could be put in place for the scheme to be effective."[3]

Heterogeneity of Products: "We should therefore consider whether measurable objectives and simple rules can be established for the operation of the scheme. This include considering the complexity of the citizen and consumer objective, the diversity of the companies potentially taking part, the number and complexity of the service covered, and the availability of expertise in designing a solution."[3]

Instability of Technology/ Heterogeneity of Products: "if… stability is achieved. Then to promote legal certainty, perhaps codification of norms established by self-regulation could take place."[2] "[Self-regulation] should not be used where rules need to apply in a uniform way." [2]

Source: [1] **Dutch Guidelines for Regulation** [2] **European Governance: White Paper, European Commission**, cited in **Bert-Japp Koops, et al., Starting Point for ICT Regulation, B-J Koops, et. al (Eds.), Starting Points for ICT Regulation, ITER, The Hague, 2006http://rechten.uvt.nl/prints/upload/200662790842312037944.pdf, 133-136,** [3] **Office of Communications, Identifying Appropriate Regulatory Solutions: Principles for Analysing Self- and Co-Regulation, 10-Dec-08http://stakeholders.ofcom.org.uk/consultations/coregulation/statement/, 16.**

Table VII-1: Characteristics that Place Limits on Self/Co-Regulation

When the activities that have been replaced involve fundamental rights or important political activities are at issue, the need for regulation is greater. The list of fundamental rights and important activities includes human rights, the rule of law, and state security. These are prominent in several of the maturation challenges that the Internet faces.

Where the need for regulation might be met with self-regulation, other considerations can mitigate against it, if the activities are so important that they cannot be left to uncertain self-regulation. Finally, where technology has stabilized significantly and there is a need for uniformity, self-regulation may not be the preferred approach because it cannot produce the desired homogeneity. Complex goals, complex products and services delivered by diverse companies raise concerns about the ability of self-regulatory schemes to succeed.

2. The Ingredients of Successful Alternative Regulation

With an array of diverse problems and a large set of possible solutions, it is critical to have a clear idea of what successful alternative governance would look like. The literature provides clear insights (see Table VII-2). Even reviews that are friendly toward reducing reliance on traditional regulation recognize that key weaknesses of the alternatives must be addressed.

Transparency/Openness

- Clarity of Purpose
  - Dialogue
  - Consensus
  - Informing policy process
  - Influencing decisions
  - Planning
  - Implementation
  - Monitoring and evaluation
  - Data gathering and analysis
- Clarity of Process/Rules
  - Governance
  - Convening
  - Decision rules
    - Voting
      - Unanimity (Veto)
      - Super Majority
      - Majority
    - Non-Voting
      - Rough Consensus
    - Right of Appeal, Dissent
- Scope of "Authority"
  - Rules only
  - Review of operations & goals

Enforcement – Compliance

- Accountability
- Fairness
- Speed
- Appropriateness
- Complaint and Audit
- Adequacy of Resources

Participation

- Public Awareness
  - Rights - Redress
  - Public consultation
- Inclusiveness
  - Access
  - Representativeness
  - Organization of groups
  - Resources
  - Expertise
  - Role of independents
- Adequacy of Resources
  - Overall
  - For NGOs
- Industry Coverage
  - Achieve Critical Mass
  - Avoid "Capture" & Ballot packing

Legal Clarity

- Relationship to government
- Formal
  - Sponsored
  - Recognized
  - Status of Decisions
    - Safe Harbor
    - Reg.-Neg.
    - Sponsored
    - Recognized
    - Preferred
    - Advisory
- Informal
  - Bully Pulpit- Nudge
  - Procurement
  - R&D
- International

Desired Results

- External
  - Credibility
  - Legitimacy
  - Effectiveness
  - Efficiency
  - Adaptability
  - Flexibility
- Internal
  - Building Trust
  - Shared Knowledge & Expertise
  - Culture of Cooperation & Leadership

TABLE VII-2: ATTRIBUTES OF AN EFFECTIVE ALTERNATIVE REGULATION STRUCTURE[12]

The widely observed lack of openness and transparency points to a fundamental question of co-regulation as regards the scope of relevant stakeholders. Most of the systems do not include consumer or viewer/listener groups in a way, which provides for formal influence with the process of decision making. . . . While transparency is a generally accepted value of good regulation the openness to specific groups is a design feature of a co-regulatory system. How the interests are balanced defines the working of the system, its acceptance and legitima Even though the objective of regulatory reform is to reduce the role of the state, one of the key ingredients of success is political – the establishment of the legitimacy of the alternative regulatory process. Legitimacy is a quintessentially political concept that is accomplished by (1) designing internal structures and processes that are seen as participatory, transparent, and fair building trust, leadership, and skills among the participants and (2) achieving external results that are

12. HANS-BREDOW-INSTITUTE, *supra* note 125, at 118-23; European Governance, *supra* note 119, at 133-40; Bart Cammaerts, *Civil Society participation in multistakeholder processes: in between realism and utopia*, *in* MAKING OUR MEDIA: GLOBAL INITIATIVES TOWARD A DEMOCRATIC PUBLIC SPHERE 83 (Laura Stein, Dorothy Kidd, Clemencia Rodriguez eds., Hampton Press, 2009).

effective.

3. Expanding the Space for Alternative Governance

a. Constitutional and Collective Choice Decisions

The process by which the space for alternative governance can be expanded can be seen as a challenge in the realm of Constitutional and Collective Choice decision-making, as depicted in Figure VII-1, which uses the recommended principles of parliamentary reform discussed above.

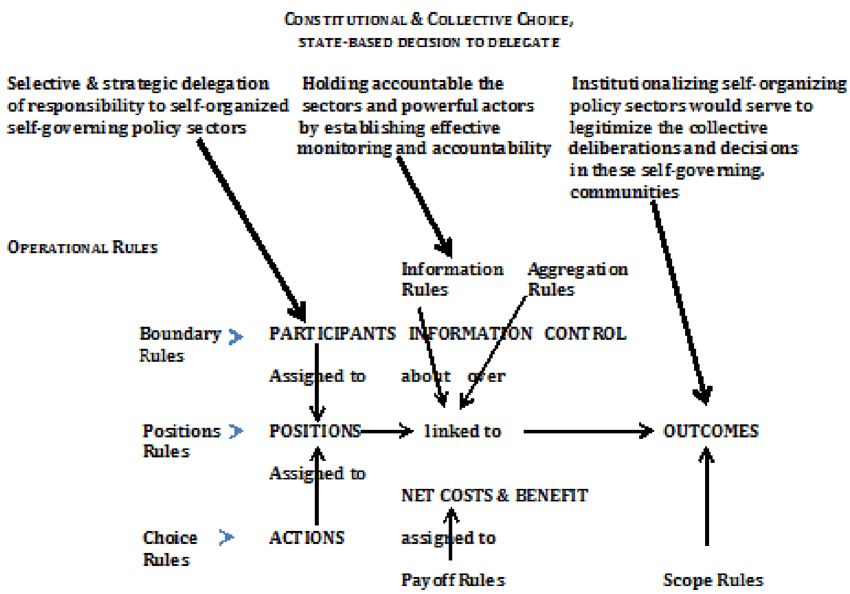


FIGURE VII-1: EXPANDING THE SPACE BETWEEN STATE AND MARKET

In building the legitimacy of alternative governance models in both the economy and the polity, the state has the important role of gracefully getting out of the way, while providing the important legal underpinning that makes significant contribution to the legitimacy of the alternative governance model. The state must provide legal clarity in selectively delegating more authority to autonomous, self-organizing policy sectors. Whether it chooses to delegate or regulate, it must reserve authority over areas where replacement has occurred and important values are at stake. In all cases, it is extremely important to seek to ensure that the institutions exhibit the key characteristics for successful oversight, including monitoring institutions for transparency, participation, and accountability.

The process of institutionalization discussed earlier is important. While it is clear that the state plays an important part in launching the authority of the alternative governance approach, over time, successful and effective alternatives build independent authority and trust. The ability of the state to revoke the authority shrinks. Eventually, any effort to rescind the authority becomes illegitimate.

b. Operational Framework for Participatory Governance

As described in Figure VII-2, participatory governance is envisioned as a multi-stakeholder process that involves industry, civil society, and technologists in both the writing and enforcement of rules. The ultimate goal is to foster compliance, rather than enforcement. The participants are the three sets of non-

governmental interests. The activities are rule writing and enforcement. It is supported by the state in the delegation decision.

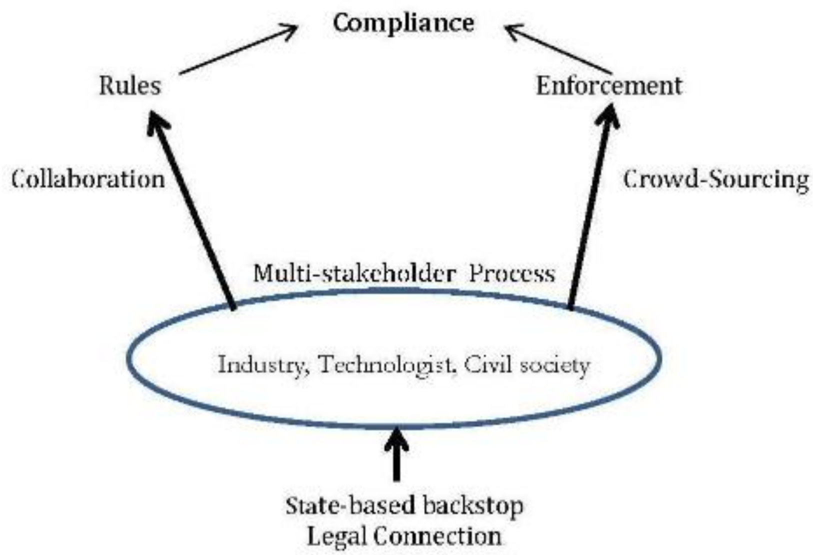


FIGURE VII-2: THE STRUCTURE OF PARTICIPATORY GOVERNANCE

We can envision two sets of possibilities, beginning with increasing activity that feeds into the regulatory process with the ultimate goal of shrinking the scope of regulatory process as the alternatives demonstrate their ability to do their job of governances (preserving the dynamic expansion of the Internet, while ensuring that the social goals are advanced).

Codes of conduct need to be developed by the multi-stakeholder process – not solely at the discretion of the industry. Codes of conduct that are developed through collaborative processes could be afforded special treatment by regulatory agencies and go into force on a fast track, but they need not be if self-regulatory enforcement and norms are strong enough. Enforcement of rules would open the door to crowd-sourcing enforcement in which the public participates directly. Complaints that are the result of the collaborative process could be granted special status and be handled in an expedited manner by the regulatory agency, or their enforcement could be through industry-based sanctions and processes.

In order to ensure that participatory governance attracts the participation necessary to make it effective and legitimate, it must fill the four voids left by the exit of the state (transparency, participation, legal clarity, and enforcement) and compensate for the failure of self-regulation. The right to appeal directly to the state would continue to exist, but the burden for success for complaints would be heavy for issues that had not been subjected to the participatory process. Complaints outside of the multi-stakeholder process cannot be prohibited, but they should bear a significantly heavier burden (a higher threshold and burden of proof). On the other hand, failure of businesses to participate should also come at a price, making complaints subject to accelerated consideration.

The most important ingredient is to ensure that the output of the new institutions is given a great deal of weight. This will provide an incentive to participate. The greater the authority of the intervening institutions, the more attention the structure should and will get. The multi-stakeholder group will have to be representative. Collaborative deliberation should be inclusive. In both cases, internal decision rules will have to be implemented (e.g., veto, super majority, majority, concurrence, and dissent).

The multi stakeholder processes would be subject to standards of representativeness, inclusiveness,

and participation, which are more explicit and likely to result in better representation than the current, inchoate approach that prevails in traditional regulation. Thus, the resulting structure will have a statutory core as the underlying legal foundation, but the bulk of the work of rule writing and enforcement will be transferred into the co-regulatory and participatory activities.

B. Enhancing the Democratic Process

Participatory governance can address many of the areas of concern about effective regulation. It can enhance public awareness, transparency, and independence of the regulatory structure by drawing members of the public and leaders of the public interest community into the process. Participatory governance also brings additional resources to enforcement, resources that are volunteered by the public in the form of participation, although the structure needs to provide additional resources for technical expertise.

The idea is to deepen democratic participation by building civil society institutions that fill the gap left by the traditional institutions of the polity. This idea has strong roots in democratic thinking in two highly developed aspects of democratic theory – the contemporary view of the public sphere and the traditional view of the press. I believe there are generally strong parallels between the two.

The unique role of the press as a civil society, public sphere institution that provides oversight over the polity and the economy has similarities to the role I envision for participatory governance. The above citations from the White Paper on representative democracy made this point directly. Elections are the primary form of participation in representative democracy that is no longer deemed sufficient for more knowledgeable, engaged publics. The press provides a primary oversight function of an engaged part of civil society.[13]

Democracy theorists and institution builders have believed for a quarter of a millennium that the press plays a central role in democracy by fulfilling two functions. The most prominent in their thinking was the role of the fourth estate to monitor and report on the other estates in society,[14] as shown in Table VII-3. However, in their prolific production of pamphlets they practiced the Fifth Estate function of mobilizing the populace to political action. The challenge with respect to participatory governance is to design structures that allow the Fifth Estate to compensate for the declining oversight functions of the state. Table VII-3 identifies the key functions of the press, which is defined as non-governmental oversight. It plays both mediated (Fourth Estate) and direct mobilization (Fifth Estate) roles.[15]

13. NORTH, *supra* note 15, at 54-55.

14. *Fourth Estate,* WIKIPEDIA, http://en.wikipedia.org/wiki/Fourth_Estate (last modified Sept. 17, 2012, 19:44) ("The Fourth Estate (or *fourth estate*) is a societal or political force or institution whose influence is not consistently or officially recognized. "Fourth Estate" most commonly refers to the news media; especially print journalism or "The Press". Thomas Carlyle attributed the origin of the term to Edmund Burke, who used it in a parliamentary debate in 1787 on the opening up of Press reporting of the House of Commons of Great Britain. Earlier writers have applied the term to lawyers, to the British queens consort (acting as a free agent, independent of the king), and to the proletariat. The term makes implicit reference to the earlier division of the three Estates of the Realm. In current use the term is applied to the Press, with the earliest use in this sense described by Thomas Carlyle in his book *On Heroes and Hero Worship*: "Burke said there were Three Estates in Parliament; but, in the Reporters' Gallery yonder, there sat a Fourth Estate more important far than they all." In Burke's 1787 coining he would have been making reference to the traditional three estates of Parliament: The Lords Spiritual, the Lords Temporal and the Commons. If, indeed, Burke did make the statement Carlyle attributes to him, the remark may have been in the back of Carlyle's mind when he wrote in his *French Revolution* (1837) that "A Fourth Estate, of Able Editors, springs up; increases and multiplies, irrepressible, incalculable." In this context, the other three estates are those of the French States-General: the church, the nobility and the townsmen. Carlyle, however, may have mistaken his attribution . . . .").

15. C. EDWIN BAKER, MEDIA, MARKETS, AND DEMOCRACY 149, 151 (2002). ("Complex democracy seeks a political process that promotes both fair partisan bargaining and discourses aimed at agreement.") (also asserting the press should be pluralist, providing individuals and organized groups with information that indicates when their interests are at stake and help mobilize people to participate and promote their divergent interests, making policymakers aware of the content and strength of people's demands. The press should promote agreement on a society-wide common good, by being inclusive and promoting thoughtful discourse, not merely being factually informative, and supporting reflection and value or policy choice. The press should promote self-reflection, informing the public about itself, so that those who disagree with the dominant opinion can contest it and provide criteria to measure government responsiveness.).

Role	Relationship to the Public	Function	Complex Democracy's Ideal Media
Fourth Estate	Mediated	Monitorial	The Checking function Independent of both government and private economic power Grounded in the pluralism of the life world Nurture non-market structures to capture positive externalities
Fifth Estate	Direct	Participatory	Participatory Democracy's Ideal Media Pluralist: Distribute politically and culturally salient media in an egalitarian manner Supports interest group formation Mobilize interests Convey public opinion to policymakers Communal: promote agreement on common good Inclusive Thoughtfully discursive Self-Reflective Inform public about itself Contest dominant opinion Criterion to measure government responsiveness

TABLE VII-3: JOURNALISM AS A PARADIGM FOR NON-GOVERNMENTAL OVERSIGHT[16]

I refer to the Fifth Estate for ease of reference and because the concept is being applied to the impact of the Internet on the contemporary communications and media landscape. It captures the essence of the direct participatory role of the public. Dutton describes the Fifth Estate[17] as follows:

> More generally, the networks comprising the Fifth Estate have two key distinctive and important characteristics: 1. The ability to support institutions and individuals to enhance their 'communicative power' . . . by affording individuals opportunities to network within and beyond various institutional arenas. 2. The provision of capabilities that enable the creation of networks of individuals which have a public, social benefit (e.g. through social networking Web sites).[18]

The analogy between the press and participatory governance can be strengthened by locating these two institutions within the public sphere.[19] The public sphere mediates between the private sphere (which comprises civil society in the narrower sense, the realm of commodity exchange and of social labor) and the Sphere of Public Authority, which deals with the state. The public sphere crosses over both these realms. Through the vehicle of public opinion it puts the state in touch with the needs of society. This area is a site for the production and circulation of discourses, which can be critical of the state. These distinctions

16. *Id.* at 129-53.

17. My use of the term "5th estate" has similarities and differences with the use Dutton makes of the term. Dutton, *infra* note 129. I agree that the emergence of the 5th estate stems for the dramatic expansion of access to information and the ability to communicate across institutional and geographic boundaries. I disagree with the suggestion that the 5th estate can supplant the 4th estate without building structures that are intended to accomplish that purpose. Interestingly, the only other reference to the explicit use of the term 5th estate that Dutton makes is to a web site that adopted the name. The web site described itself as serious and satirical commentary and appears to be defunct (with no entry after July 2009). This example underscores the two characteristics of the 5th estate that distinguish it from the 4th estate. It is largely commentary and its durability over time at the level of individual organizations is suspect. Others have argued that the 5th estate is necessary to monitor the 4th estate. Ironically, if the 4th estate were doing a better job, the need for and role of the 5th estate in this regard would be reduced, but its broader role in democratic discourse would continue.

18. William H. Dutton, *The Fifth Estate Emerging Through the Network of Networks*, 27 PROMETHEUS 1, 3 (2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1167502.

19. Here I paraphrase the formulation offered in Wikipedia. Wikipedia is a perfect example of how the public sphere has expanded through the creation of new forms of mass communications. *See Public Sphere*, WIKIPEDIA, http://en.wikipedia.org/wiki/Public_sphere (last modified Sep. 5, 2012, 21:11).

between state apparatuses, economic markets, and democratic associations are essential to democratic theory. The study of the public sphere centers on the idea of participatory democracy and how public opinion becomes political action.

Figure VII-3 depicts a map of the media in a public sphere that has become much more complex and the make-up of the media much more diverse. The Figure is drawn to emphasize the fact that the growth has been in those areas of the media that are best suited to Fifth Estate functions. The challenge is to harness the Fifth Estate energy to accomplish the Fourth Estate oversight functions.

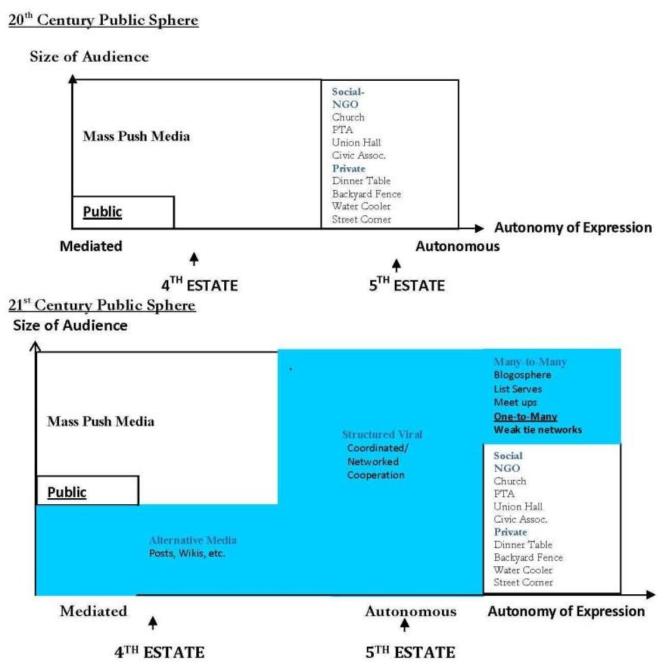


FIGURE VII -3: INCREASING DIVERSITY IN THE EXPANDING DIGITAL PUBLIC SPHERE

The Fifth Estate function is distinct from the Fourth Estate function, although it is generally hoped that monitoring society and informing the public will get them to act, but mobilizing is a different type of activity and the ability of Fourth Estate activity to mobilize people in the 20th century is debatable. The ability of unmediated viral communications to create strong collective action in the digital age has been widely noted.[20] Unmediated communications predominates in cyberspace because the medium is naturally suited to do this. There is a lively debate about whether the commercial mass media accomplished it function in the 20th century when commercialism overwhelmed journalism.[21] The goal of participatory governance is

20. *See, e.g.*, CLAY

SHIRKY, HERE COMES EVERYBODY: THE POWER OF ORGANIZING WITHOUT ORGANIZATIONS, 2009; REBECCA MACKINNON, CONSENT OF THE GOVERNED: THE WORLDWIDE STRUGGLE FOR INTERNET FREEDOM, 2012.

21. BAKER, *supra* note 131, at 184, 187, 191 (The critique of 20th century journalism stems in large measure from the fact that its functions became obscured by its transformation into a commercial mass media enterprise.) ("[C]omplex democracy fears that the watchdog will be muzzled, whether by government or private power. . . .[M]onopolization or corrupted segmentation will suppress or disfigure media pluralism," because "[m]arket-determined segmentation predictably disfavors, for example, media focusing on political ideology, non-market-valued ethnic and cultural divisions, economically poorer groups . . . . When properly performing its various democratic functions, the media generates significant positive externalities – that is, benefits to people other than the immediate consumer of the product. The economic meaning . . . is that . . . free markets will under-produce these quality products.").

to expand the role of public sphere institutions as the state role shrinks. In the analogy to the press, I propose that participatory regulation can play a Fourth Estate function and infuse it with Fifth Estate energy.

B. Conclusion

Because the Internet and the digital networks on which it rides have become central institutions in societal and global communications and commerce, they can be described as "affected with a public interest."[22] The concept of public obligations falling on private enterprises is as old as capitalism itself.[23] While this term might strike fear into the hearts of some Internet stakeholders, because it evokes the specter of the utility-style common carrier regulation of the 20th century, the concept has a much longer and richer history that encompasses many forms of regulation that are much less intrusive.

While common carrier, public utility regulation was applied to certain large infrastructure industries over the course of the 20th century, many activities deemed to be affected with the public interest have been governed by criminal[24] and common law[25] (e.g., restaurants and other public places), prudential regulation (e.g., banks and insurance companies), or subject to self-regulation (e.g., professions like medicine and law).

On the one hand, it can be argued that in the 500-year history of the treatment of the public interest in capitalist society, command and control regulation is the exception, not the rule. On the other hand, it can also be argued that in the 500-year history of capitalism, the means of communications and transportation of commerce have always been regulated and have been required to shoulder unique responsibilities.

Thus the history of the concept of "affected with a public interest" argues for a careful consideration, not whether the Internet should shoulder new responsibilities, but how the obligations that the digital revolution must shoulder can be implemented in a way to preserve its dynamic nature. There is no reason to believe that one-size will fit all. In fact, the challenges have different causes and interact with the Internet ecology in different ways. Therefore, different institutional structures are likely to be better suited to meet specific challenges.

This analysis indicates that the successful model should not be asked to take on tasks for which it is not well suited. Internet governance involved highly technical issues that were debated primarily by technicians in an open format. The challenges that are primarily economic, social, and political will be difficult for the Internet institutions to deal with. The ability to separate technical from policy issues is sufficient to promote this balanced outcome. To a significant degree technology creates possibilities, while policies influence which paths are chosen. The perception of the nature of the challenges varies greatly

---

22. *Business Affected with a Public Interest*, THEFREEDICTIONARY.COM, *available at* http://legal-dictionary.thefreedictionary.com/Business+Affected+With+a+Public+Interest (last visited Sept. 12, 2012) ("A commercial venture or an occupation that has become subject to governmental regulation by virtue of its offering essential services or products to the community at large. A business affected with a public interest is subject to regulation by the Police Power of the state to protect and to promote the General Welfare of the community which it serves. Such a designation does not arise from the fact that the business is large, or that the public receives a benefit or enjoyment from its operation. The enterprise, as a result of its integral participation in the life of the community or by the privilege it has been granted by the state to serve the needs of the public, is regulated more strictly by the state than other businesses. What constitutes a business affected with a public interest varies from state to state. Three classes of businesses have been traditionally regarded as affected with a public interest: (1) those carried on pursuant to a public grant or privilege imposing a duty of making available essential services demanded by the public, such as common carriers and Public Utilities; (2) occupations considered from the earliest times in common law to be exceptional, such as the operation of inns or cabs; and (3) businesses that although not public at their inception have become such by devoting their activities to a public use, such as insurance companies and banks. A business affected with a public interest remains the property of its owner, but the community is considered to have such a stake in its operation that it becomes subject to public regulation to the extent of that interest.").

23. *See* James Speta, *A Common Carrier Approach to Internet Interconnection*, 54 FED. Comm. L.J. 225, 254 (2002).

24. *Criminal Law*, WIKIPEDIA, http://en.wikipedia.org/wiki/Criminal_law (last visited Sept. 11, 2012).

25. *Common Law*, WIKIPEDIA, http://en.wikipedia.org/wiki/Common_law (last modified Oct. 1, 2012, 17:15); *Civil Law (Common Law)*, WIKIPEDIA, http://en.wikipedia.org/wiki/Civil_law_(common_law) (last modified Oct. 1, 2012, 20:57).

across stakeholders and nations, with some seeing the functionalities technology provides as positive or negative, depending on the point of view of the stakeholder. In every area, technology has two sides, as noted above. For example,

- The ability to gather, store, and seamlessly transfer large quantities of information about consumers is seen as a threat to privacy by public interest advocates, while content owners and Internet companies see it as a positive way to fund and target the distribution of content and services.
- The ability to gather, store, and seamlessly transfer large quantities of perfectly replicable data is seen as a threat to intellectual property by content owners, who brand it as piracy, while public interest advocates see it as a major improvement in the ability of consumers to make fair use of content.
- The ability to monitor and prevent disruptive uses of the Internet is seen as an important tool to improve cyber security by some, or as a threat to freedom of speech, an invasion of privacy, or denial of freedom of assembly, by others.
- The winner-takes-most nature of digital markets that creates huge, dominant entities in many areas of the digital economy is seen as the efficient outcome by some and a major threat of abusive market power by others.

If we try to solve each of these important social policy challenges by tinkering with the basic structure of the resource system to impose changes, we run a very high risk of destroying its core structure (its communications protocols and governance institutions) and undermining its ability to function at the high level to which we have become accustomed. Responses to the maturation challenges should be crafted at the layer and in the realm in which they arise. Because the digital revolution has had such a profound and beneficial impact across all the realms of social order, reaching across layers and realms to solve problems is likely to have negative, unintended consequences. This is particularly true when the technology layer is involved.

The goal of a communications standard is to make activity possible. The more activity the standard supports, the better. The goal of policy is to direct activity in socially beneficial directions and dissuade socially harmful actions. The combination of successful self-regulation of the Internet and the light handed regulation of nondiscrimination on the telecommunications network was the bedrock of the digital revolution and produced decades of unparalleled innovation and growth in communications. They deserve a great deal of deference. Above all, those who would abandon the model or break the Internet altogether by abandoning its principles bear a heavy burden of proof. This applies to governments, network operators and civil society groups.