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

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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 21st 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

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[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)

carries weight. The National Broadband Plan is the result of the Congressional desire to have a 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.

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[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]

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[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."

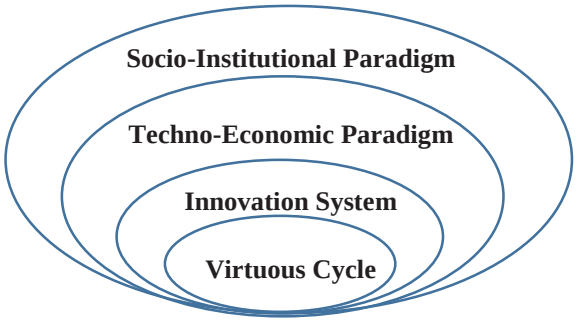
[16] Mark Cooper, Initial Comments of The Consumer Federation of America, *In the Matter of The Open Internet Remand*, Federal Communications Commission, GN Docket No. 14-28, February 25, 2014.

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

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

show that digital communications are a particularly powerful Innovative System. At a similar 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

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

---

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."

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]

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[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

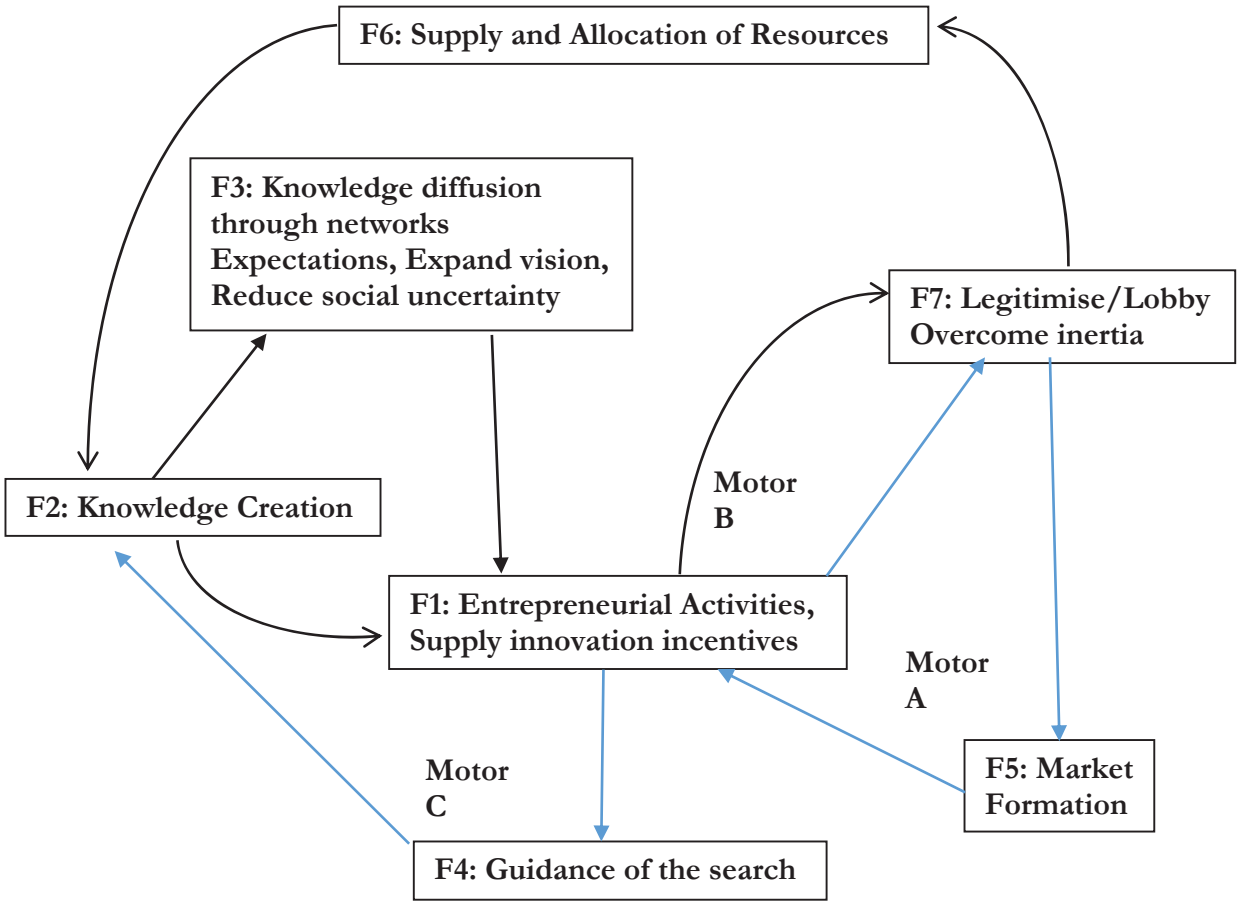
One approach that has received a lot of attention is the analysis of "innovation systems," which takes an institutional and evolutionary view of technological change.

> 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):

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

- FaceTime blocking over mobile devices unless using Mobile Share plan (2012):
- 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.

[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.

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 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

[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.

> 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.

> 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]

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[44] Greenstein, 2010:500-501.

[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

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] 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

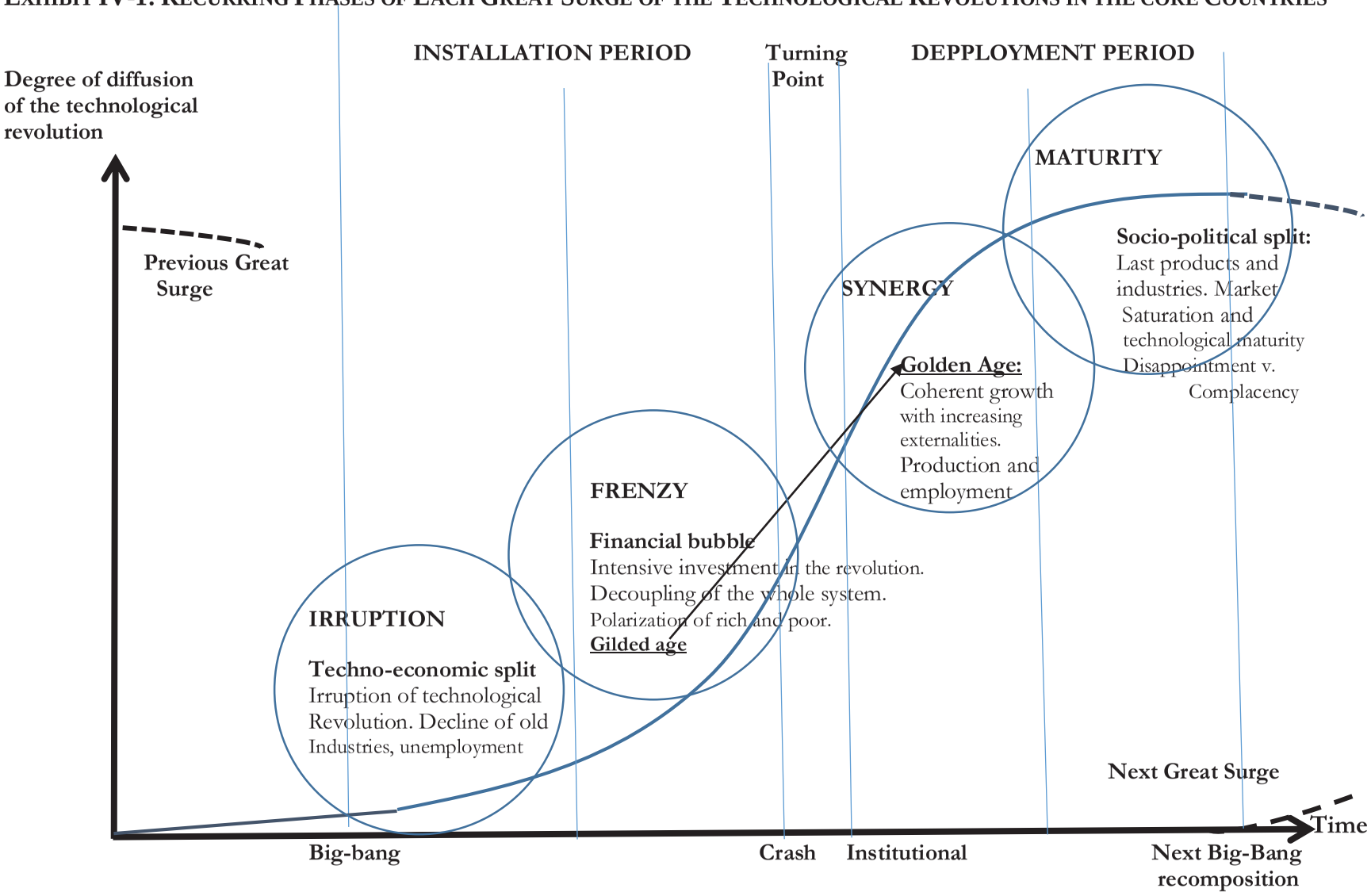
. and Exhibit IV-2, shows the stages that each of the capitalist technology revolutions have passed through in the industrial era.

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.

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.

[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, Germany	1875 Carnegie Bessmer Steel	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 2007-2008 Emerging Markets	2000	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.

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[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]

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[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]

---

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

Thus, agency, asymmetric information and conflicts of interests are the barriers and imperfections in that drive organizations farther from the goal of efficiency.

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

[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.

the findings of behavioral economics can be usefully divided into four groups – motivation, perception, calculation and execution. Wilkinson's *Introduction to Behavioral Economic,* has 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

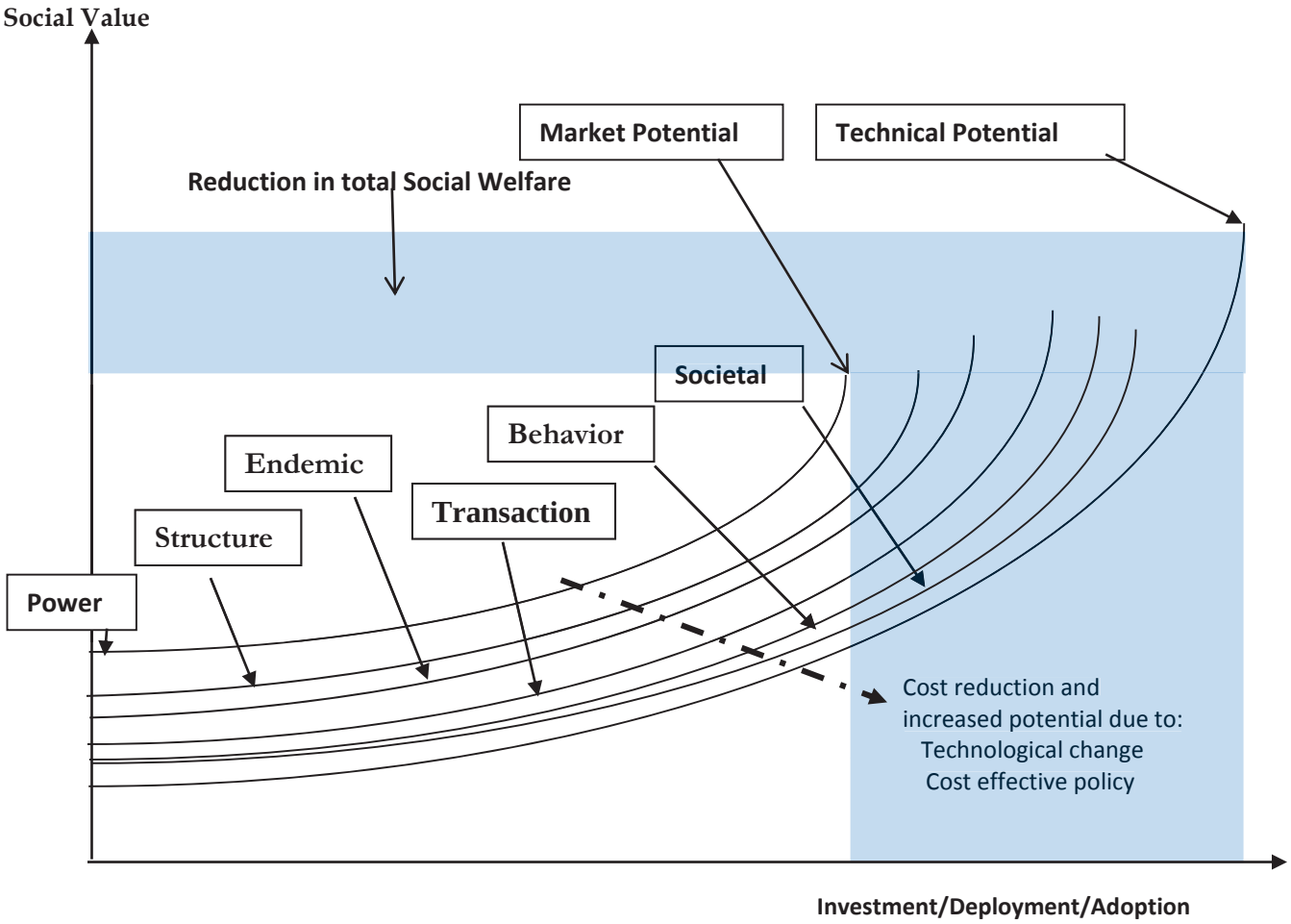
B. BROAD ANALYTIC FRAMEWORKS

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

INDUSTRY STRUCTURE
Imperfect Competition
- Concentration
- Barriers to Entry
- Scale
- Vertical Leverage
- Collusion

ICE problems
- Price discrimination
- Entry barrier
- Bargaining

Technology
- R&D
- Investment

Marketing
- Bundling: Multi-attribute
- Product Differentiation
- Gold Plating
- Inseparability
- Purchase Method
- Advertising

Cost-Price
- Level
- Structure
- Product cycle
- Disaggregated/ fragmented Mkt.

Ownership
- Control
- Transfer
- Limited payback
- Lack of premium

Elasticity
- Own-price
- Cross-price
- Income

Availability
- Backward bending supply
- Lack
- Emergency replacement
- Poor Quality

Regulation
- Price Distortion Avg-cost
- Permitting

SOCIETAL FLAWS

Traditional Externalities
- Positive
- Negative

Public Goods
- Basic research
- Information
- Learning-by-doing
- Learning-by-using

Network Effects
- Direct
  - User
  - Nonuser
- Indirect
- Cross platform

Innovation Economics
- General Purpose Tech.
- Producer surplus
- Consumer surplus
- Prosumers
- Productivity
- Applications
- Co-invention

Non-economic Values

POWER

Legal Framework
- Property
- Contract

Policy
- Taxation
- Subsidies
- Protectionism
- Trade

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

Regulatory Capture

NEW INSTITUTIONAL & BEHAVIORAL ECONOMICS

ENDEMIC TENDENCIES

Asymmetric Information
- Agency
- Moral Hazard
- Adverse Selection

Perverse Incentives

Conflict of Interest

Inequality
- Physical Capital
  - Maldistribution
  - Insufficiency
- Human Capital
  - Health
  - Education

Macroeconomic Imbalances
- Income/ Demand Insufficiency
- Investment Instability

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

BEHAVIORAL FACTORS

Motivation Values & Commitment
- Bounded Selfishness/wants
  - Morality
  - Fairness/reciprocity
  - Altruism
  - Preference
  - Custom
  - Social group & status

Perception
- Bounded Vision/ Attention
- Prospect
  - Framing
  - Loss Avoidance
  - Status Quo, habits/inertia
  - Salience
- Self-fulfilling Prophesy
- Social Influence
  - Awareness
  - Attention
  - Low priority

Calculation
- Bounded rationality
  - Ability to process info
  - Limited understanding
  - Heuristic Decision Making
    - Rules of thumb
    - Information
  - Discounting
    - Low Probability Events
    - Long-Term
    - Small Outcomes

Execution
- Bounded Willpower
  - Improper use
  - Improper maintenance

(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.

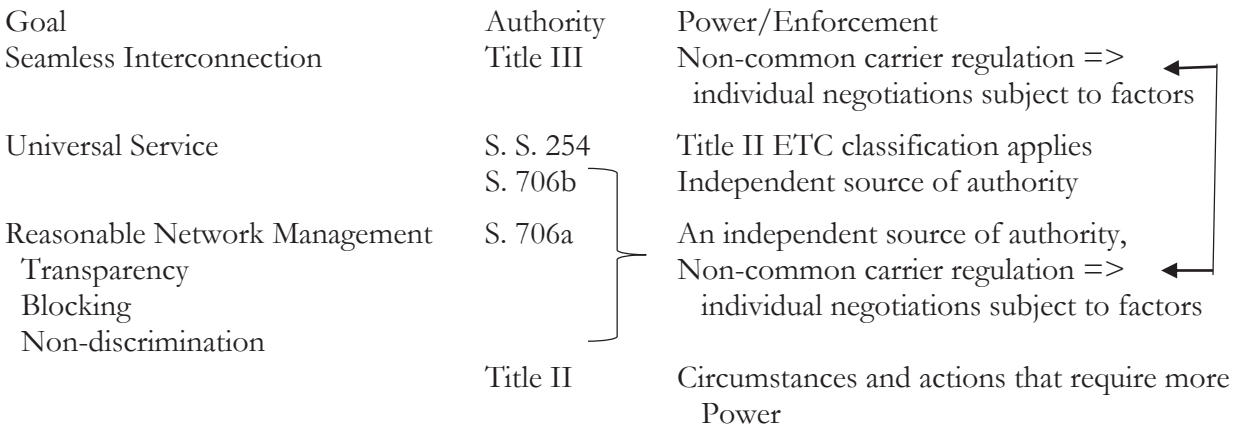
B. The Emerging Regulatory Structure for Non-Common Carrier Services

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



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]

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

The no blocking rule should have the effect of ensuring that the data traffic flows during any 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.

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

Not only are the acts logically distinguishable, but they are also likely to be very different. As 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