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An Innovation-Centric Approach of Telecommunications Infrastructure Regulation

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ABSTRACT

This paper considers the mechanics and role of innovation in telecommunications networks and explains how regulation can be designed to maximize innovation. Several reasons are presented for why the fast-changing, networked, and technical nature of telecommunications offers a favorable environment for innovation to thrive, as well as why innovation benefits from a large number of actors. Moreover, the Article further explains that even small players are useful in the innovation process and that a decentralized polyarchic system of innovation can work, without that meaning that it is superior to centralized innovation. The Article suggests that the goal of a diverse and populous pool of actors is reconcilable with both the high barriers to entry in telecommunications and the disincentives sharing obligations may create. The key is to construct a system of regulation whereby entry is facilitated only while competition remains underdeveloped. The overall tradeoff is a few years of managed competition and suppressed incentives for a properly working competitive market in the long run.

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I. INTRODUCTION

The telecommunications sector has undergone a sea change in previous decades as it transitioned from monopoly to competition. The new environment accommodated, along with incumbents, another set of actors—the competitive entrants—that presented regulators with new dilemmas as to how the relationships between all the involved actors should be shaped.[1] Even today, many of the regulatory efforts are geared toward managing this policy-induced competition. Along with competition the concept of innovation gradually rose to prominence. However, it was rarely treated separately from competition, and little concord has been achieved as to the most appropriate innovation-friendly policy.

Over the years two major approaches to policy have been advanced, each one with its own success and failure stories: one side claims that minimum regulatory intervention will allow competitive forces to steer the industry to an equilibrium; the other end of the spectrum views heavy regulatory intervention as necessary, because the market alone does not provide the necessary thrust to overcome monopolies or oligopolies, which for the purposes of innovation do not yield the best results. While this debate has been active for many years now, and to a large extent regulatory authorities have managed to establish a working regulatory framework, every new technology that requires large investments re-poses the same dilemma. The deployment of fiber networks, for instance, calls for a de novo assessment of the appropriate policy, one that will not be overly intrusive and risk chilling investments, but that can, at the same time,

[1] *See* REGULATION UNDER INCREASING COMPETITION 1–16 (Michael A. Crew ed., 1999); *see also* JOHN HOWELLS, THE MANAGEMENT OF INNOVATION AND TECHNOLOGY: THE SHAPING OF TECHNOLOGY AND INSTITUTIONS OF THE MARKET ECONOMY 85–88 (2005).

guarantee a healthy market.[2] Indeed, the United States, the European Union, and many Asian states are all currently contemplating whether they should keep their old regime in place, or whether a new model of regulation better addresses the future needs of the telecommunications sector.[3]

This Article, recognizing the recurrent timely theme of the relationship between regulation and innovation, seeks to examine the peculiarities of the innovation process in the telecommunications industry and to analyze different regulatory schemes through the lens of achieving maximum innovation. While competition and innovation are often thought to coexist and to constitute a unity for regulatory purposes,[4] some important differences persist. An effort will thus be made, where necessary, to highlight these differences, because acknowledging innovation as a separate regulatory goal may have striking implications as to the appropriate policy. Most notably, because network innovation seems to be drawing significant benefits from an enlarged pool of actors, even if they are less efficient than a single big actor, and because distributed polyarchic decision-making systems are well-suited for supporting rapidly evolving markets, regulators wishing to prioritize innovation may be required to intervene in favor of facilitating entry (e.g., by promulgating some kind of network sharing) more than competition alone would. However, authorities should also be aware of the regulatory cost that comes together with sharing obligations, most notably that they can harm both incumbents' and entrants' incentives to invest. Therefore, to be effective, regulation should be temporary, lasting only until competitors have strengthened their position in the market. The overall tradeoff is a few years of managed competition and suppressed incentives for a properly working competitive market in the long run.

In that direction, this paper proceeds as follows: Part II attempts a brief innovation-centric account of recent telecommunications history with the view to highlight the principal role of innovation in decisions that affected the nature of the telecommunications networks. The consistency with which innovation has been served throughout the telecommunications history indicates that it is indispensable in the development of the sector. Part III then moves on to examine the mechanics of innovation in telecommunications networks, explaining what factors are important for innovation and how the telecommunications environment provides the necessary conditions for innovation to thrive. Lastly, in Part IV, I review possible solutions for how to regulate the physical layer of wireline and wireless networks to achieve maximum innovation. The basic goal is to create a diverse and populous pool of actors, which is

[2] *Cf.* Jerry A. Hausman et al., *Valuing the Effect of Regulation on New Services in Telecommunications*, 1997 BROOKINGS PAPERS ON ECONOMIC ACTIVITY, MICROECONOMICS 35 (1997).

[3] For the United States, see FCC, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN 37 (2010), *available at* http://download.broadband.gov/plan/national-broadband-plan.pdf; for the European Union *see* Directive 2009/140/EC of the European Parliament and of the Council of 25 November 2009, 2009 O.J. (L 337) 37. For Asia, see THE BERKMAN CENTER FOR INTERNET AND SOCIETY, FINAL REPORT TO THE FCC, NEXT GENERATION CONNECTIVITY: A REVIEW OF BROADBAND INTERNET TRANSITIONS AND POLICY FROM AROUND THE WORLD 283–89, 298–305, (2010), *available at* http://cyber.law.harvard.edu/pubrelease/broadband/.

[4] *See* CHARLES B. GOLDFARB, TELECOMMUNICATIONS ACT: COMPETITION, INNOVATION, AND REFORM 5-35 (2006).

reconcilable with both the high barriers to entry in telecommunications and the disincentives that sharing obligations may create. The key is to construct a system of regulation whereby entry is facilitated only while competition remains underdeveloped.

II. A HISTORIC ACCOUNT OF INNOVATION'S ROLE IN THE REGULATION OF TELECOMMUNICATIONS NETWORKS

While all stakeholders in the telecommunications sector would agree that innovation is a venerable goal, little concord exists on the issue of how to achieve and maximize it. The reason is that the involved parties come from different backgrounds, which in turn creates different approaches regarding innovation. During the simple times when telecommunications were a regulated monopoly, the source of innovation was the monopoly firm that operated under the auspices of the government (AT&T).[5] The gradual transition from a regulated monopoly to an increasingly competitive regime introduced competitive entrants to the telecommunications industry, who added new sources of innovation. Regulatory efforts have since focused on creating such conditions where both incumbents and new entrants are able to innovate.

In this context finding a regulatory balance is hard as incumbents and competing entrants are motivated by conflicting pursuits: incumbents want exclusive control over their existing infrastructure and any future investments, while competitive entrants ask regulators to grant them access and sharing rights to the incumbents' network at least for as long as their own network remains underdeveloped.

Over time regulators became increasingly receptive to competitive entrants' arguments that only regulation could address the peculiarities of the telecommunications system, namely natural monopoly characteristics,[6] economies of scale and scope,[7] and network effects (also known as network externalities).[8] Legal scholars who started questioning the benefits of natural monopolies and the public benefit theory that used to underpin AT&T's natural monopoly further supported the transition to a more

[5] Government regulation played a key role in solidifying AT&T's monopoly after the expiration of Bell Telephone Company's patents in 1894 and until AT&T's breakup in 1984 (Bell Telephone Company, in the meantime, was acquired by AT&T in 1899). *See* Adam D. Thierer, *Unnatural Monopoly: Critical Moments in the Development of the Bell System Monopoly*, 14 CATO J. 267 (1994). Its subsidiaries, AT&T Corp. and AT&T Communications offer local and long distance services respectively. AT&T, Inc. today constitutes much of the original AT&T before the 1984 breakup.

[6] Rick Geddes, *Public Utilities*, *in* ENCYCLOPEDIA OF LAW AND ECONOMICS 1161, 1165–67, 1183 (Boudewijn Bouckaert & Gerrit De Geest eds., 2000).

[7] John C. Panzar & Robert D. Willig, *Economies of Scale in Multi-Output Production*, 91 Q. J. OF ECON. 481 (1977); John C. Panzar & Robert D. Willig, *Economies of Scope*, 71 AM. ECON. REV. 268, 268 (1981).

[8] Nicholas Economides, *Network Economics*, 14 INT'L J. INDUS. ORG. 673, 679 (1996)*; see also* JEFFREY H. ROHLFS & HAL R. VARIAN, BANDWAGON EFFECTS IN HIGH TECHNOLOGY INDUSTRIES 13, 69 (2003); Harvey Leibenstein, *Bandwagon, Snob and Veblen Effects in the Theory of Consumer Demand*, 64 Q. J. OF ECON. 183 (1950).

participatory environment.[9] This contributed to a gradual shift towards more competition, which in turn created a more diverse and innovation-friendly environment. On top of that, the fast pace of technological change—which plays a defining role in the development of the telecommunications sector[10]—and the growing generativity of communications networks,[11] had their own share in the opening-up of the telecommunications sector to more actors and in elevating innovation into a prominent driving force of progress.

These changes are traced in the following pages from the early stages of liberalization to today's competitive environment. As will be shown, the telecommunications sector, both in terms of equipment and in terms of services, has shown remarkable growth and has changed significantly in composition and diversity.

A. Innovation in Telecommunications Equipment

In an era not so long ago, telephone service customers did not have a choice as to the equipment they could use in connection with the telephone network. The telephone equipment came bundled with the telephone service, and no third-party equipment for any use was allowed to be connected to the telephone network.[12] This was considered reasonable based on the assumption that any foreign attachments could compromise the security and quality of the network.[13] It is noteworthy, however, that AT&T failed to provide evidence that the foreign devices could indeed physically impair the network. Yet the Federal Communications Commission (hereinafter the Commission) sided with AT&T, and on several occasions it concluded that foreign devices were "deleterious to the telephone system."[14]

This arbitrary approach (that seemed to serve only AT&T) could not survive for long. In 1968 the Commission was faced with the now widely celebrated *Carterfone* case,[15] which presented precisely the issue of connecting third-party devices to the network. This time the conditions had matured, and the Commission was more receptive to competitive third-party equipment.[16] While it recognized that the foreign terminal

[9] Richard A. Posner, *Theories of Economic Regulation*, 5 BELL J. OF ECON. & MGMT. SCI, 335 (1974). *See also* William G. Shepherd, *"Contestability" vs. Competition*, 74 AM. ECON. R. 572 (1984); Sumit K. Majumdar, *Incentive Regulation and Productive Efficiency in the U.S. Telecommunications Industry*, 70 J. OF BUS. 547 (1997).

[10] *See* RICHARD A. GERSHON, TELECOMMUNICATIONS AND BUSINESS STRATEGY 138 (2008).

[11] While the term "generativity" was coined by professor Jonathan Zittrain to describe a quality of the Internet, older telecommunications networks also show signs of generativity, as exemplified by the *Carterfone* decision. *See* Jonathan Zittrain, *The Generative Internet*, 119 HARV. L. REV. 1974 (2006).

[12] PETER W. HUBER ET AL., FEDERAL TELECOMMUNICATIONS LAW 651 (2d ed. 1999).

[13] *See* Jordaphone Corp. of America v. AT&T, 18 F.C.C. 644 (1954); Hush-a-Phone Corp. v. AT&T, 20 FCC 391 (1955).

[14] Hush-a-Phone Corp. v. United States, 238 F.2d 266, 268 (D.C. Cir. 1956) (The *Hush-a-Phone* case was appealed to the District of Columbia Court of Appeals, which remanded the case for lack of "findings to support these conclusions of systemic or public injury," but not because the prohibition for security reasons was itself unlawful.).

[15] Carter v. AT&T, 13 F.C.C. 2d 420 (1968).

[16] The rise of the computer industry in the 1960s, which remained largely unregulated and from which AT&T was banned by virtue of the 1956 consent decree, as well as the close relationship it developed with

equipment violated AT&T's regulations, called tariffs, it held that the tariffs themselves were unlawful for being "unreasonable and unduly discriminatory."[17] This sweeping decision opened the way to competitive equipment, and for the first time consumers could purchase a telephone in a style and color other than AT&T's "colorful black,"[18] as former Commissioner Nicholas Johnson had put it.

The beneficial effect of the *Carterfone* decision on innovation speaks for itself in the number of new products that inundated the market following the decision. The fax machine, answering machines, and most importantly the modem, which popularized Internet access in the early 1990s, are all inventions that were enabled by the new telecommunications policy.[19] To put it briefly, "the key point of *Carterfone* is that it eliminated an innovation bottleneck in the form of the phone company."[20]

Carterfone was only the beginning. The success of this pro-innovation policy was so overwhelming that it was later transferred outside the wireline telephony domain. Early in the 1980s consumers were offered data processing services, besides the traditional voice telephony services. These "enhanced services" included voicemail, electronic publishing, and currently all Internet services. The Commission was quick to discern that "the continuation of tariff-type regulation of carrier provided CPE [Customer Premises Equipment] neither recognizes the role of carriers as competitive providers of CPE nor is it conducive to the competitive evolution of various terminal equipment markets."[21] In requiring accordingly that common carriers separate the selling of equipment from the provision of services, the Commission noted that this policy was "an outgrowth of [its] [Hush-a-Phone] and [Carterfone] decisions."[22] Years later, the freedom to manufacture and connect any kind of equipment was reaffirmed for the Internet environment too.[23] This way anyone could come up with innovative equipment, be it a

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the telecommunications industry, put increasing pressure on regulators to weaken AT&T's monopoly. *See* Kevin Werbach, *The Federal Computer Commission*, 84 N.C.L. REV. 1 (2005) (tracking the evolution of computer regulation by the FCC); Delbert D. Smith, *The Interdependence of Computer and Communications Services and Facilities: A Question of Federal Regulation*, 117 U. PA. L. REV. 829 (1968), Comment, *Computer Services and the Federal Regulation of Communications*, 116 U. PA. L. REV (1967) (both examining the relationship between the unregulated computer industry and the regulated telephone industry).

[17] *In re* Use of the Carterfone Device in Message Toll Telephone Service, 13 F.C.C. 2d 420, 423–26 (1968). After AT&T was forced to abandon the tariffs, it replaced them with a more flexible policy, the protective connecting arrangements (PCA), ostensibly to protect the network's viability. Years later, when the Commission was convinced that AT&T's protectionism was aimed at achieving equipment monopoly and not network security, it adopted its own product certification policy by instituting the FCC Certification process. *See* CHRISTOPHER H. STERLING ET AL., SHAPING AMERICAN TELECOMMUNICATIONS: A HISTORY OF TECHNOLOGY, POLICY, AND ECONOMICS 124–27 (2006).

[18] Nicholas Johnson, Carterfone*: My Story*, 25 SANTA CLARA COMPUTER & HIGH TECH. L.J. 677, 684 (2009).

[19] Tim Wu, *Wireless* Carterfone, 1 INT'L J. OF COMM. 389, 397 (2007).

[20] *Id*. at 397.

[21] Second Computer Inquiry, 77 F.C.C. 2d 384, 446 (1980).

[22] *Id*. at 440.

[23] Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, 20 FCC Rcd. 14986, 14988 (2005) ("To encourage broadband deployment and preserve and promote the open and

modem or a Voice over Internet Protocol (VoIP) phone, thereby preserving and promoting the open nature of the Internet.

In recent years, there has been a growing movement to allow third-party equipment to connect to wireless networks too. For reasons that will become clearer infra in Part IV.C, activity in the spectrum is still characterized by strict protectionism, but some exceptions are beginning to surface. For example, the Commission has adopted a clear policy of open and innovative equipment market in the 700 MHz Upper C Block of wireless communications.[24] According to the Commission's reasoning justifying its actions, the market had failed to achieve broader social goals and its intervention was deemed necessary to secure "the benefits of choice, innovation and affordability to American consumers . . . ."[25]

Likewise, the Commission has progressively made certain bands of the spectrum available for use without obtaining a license at all. This means that anyone can connect to the network any device that passes a standards certification. Maybe the most familiar example is currently the 2.4/5GHz bands that are reserved for what is commonly known as Wi-Fi, which forms part of the unlicensed spectrum.[26] While the 2.4/5GHz bands are not the only unlicensed bands,[27] they are surely the most commercially successful. In fact, the 2.4GHz band has proven so flexible and is "so filled with devices such as microwave ovens, cordless telephones, and baby monitors that it is known as the 'junk band.'"[28]

It has been a long way from *Carterfone* to Wi-Fi. The gradual opening up of the equipment market is what enabled consumers to go from the exclusive "colorful black" telephone to being able to connect any Wi-Fi compatible device to a Wi-Fi network and make free calls over IP or surf the Internet. Regulators have undoubtedly moved slowly. However, the regulatory lag or the obstacles that competing interests pose notwithstanding, the underlying pattern governing telecommunications equipment (and what users can do with it) is geared toward increasing competition and innovation. As we will see in the next chapter, innovation in the services market has followed a similar path,

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interconnected nature of the public Internet, consumers are entitled to connect their choice of legal devices that do not harm the network.").

[24] Serv. Rule for the 698-746, 747-762, & 777-792 MHz Bands, 22 FCC Rcd. 15289, 15294 (2007). The Commission noted that it has not yet "made a finding regarding whether to apply open access requirements to wireless broadband services generally, and in this Order, defers that determination to the appropriate pending [Skype petition]." *Id*. at 15363.

[25] *Id*. at 15362.

[26] Authorization of Spread Spectrum Systems Under Parts 15 and 90 of the FCC Rules and Regulations, 50 Fed. Reg. 25234-01 (June 18, 1985) (to be codified at 47 C.F.R. 2, 15, 90); *see also* Amendment of the Comm'n's Rules to Establish New Narrowband Personal Commc'ns Servs., 9 FCC Rcd. 6388 (1993).

[27] For an evolutionary presentation of the unlicensed bands, see Kenneth R. Carter, *Unlicensed to Kill: A Brief History of the Part 15 Rules*, 11(5) INFO: THE JOURNAL OF POLICY, REGULATION AND STRATEGY FOR TELECOMMUNICATIONS, INFORMATION AND MEDIA 8 (2009).

[28] Kevin Werbach, *Open Spectrum: The New Wireless Paradigm* (New Am. Found. Spectrum Series Working Paper No 6, 2002).

thus contributing to the establishment of innovation as a prime regulatory and market goal.

B. Innovation in Telecommunications Services

Like in the equipment market, telecommunications services were initially tethered to AT&T's monopoly and were dependent upon AT&T's corporate strategy. Alternative telecommunications services were not only barred by the state-imposed exclusive franchise to AT&T, but also (even if they were allowed to compete) from the prohibitively high cost of entry into the telecommunications sector.[29] When microwave technology became commercially available in the 1940s, dramatically dropping the cost of offering communications services, this situation began to change.[30]

Naturally, AT&T first tried to thwart competition,[31] but in a bold step, the Commission decided to side with the promising and upcoming class of competing service providers and adopted the famous *Above 890* decision, whereby it allocated frequencies above 890 MHz to private users (as opposed to common carriers).[32] The Commission rejected the common carriers' fears that opening microwaves to private users would adversely affect their ability to serve the general public or provide a nationwide communications service.[33] It was convinced that there were enough available frequencies,[34] and, if anything, technological progress would increase the bandwidth in the future.

The *Above 890* decision opened the way to unprecedented innovation in services. The Commission opined that "a general policy in favor of the entry of new carriers in the specialized communications field would serve the public interest, convenience, and necessity."[35] Indeed, within a decade of MCI's first filing of an application to construct a private microwave communications system in 1963,[36] almost 200 companies requested to be recognized as alternative service providers under the name of Specialized Common Carriers (SCC).[37] SCCs began offering services that ranged from exclusive data

[29] Before the microwave technology became commercially available competitors were limited to niche local markets and scarce voice services. *See* GERALD W. BROCK, TELECOMMUNICATION POLICY FOR THE INFORMATION AGE: FROM MONOPOLY TO COMPETITION 102–03 (1994).

[30] *See* William Meckling, *Economic Potential of Communication Satellites*, 133 SCI. MAG. 1885 (1961).

[31] *See* MILTON L. MUELLER, JR., UNIVERSAL SERVICE: COMPETITION, INTERCONNECTION AND MONOPOLY IN THE MAKING OF THE AMERICAN TELEPHONE SYSTEM 104 (1997); *see also* Charles Phillips, *Domestic Telecommunications Policy: An Overview*, 29 WASH. & LEE L. REV. 235, 239 (1972).

[32] Allocation of Frequencies in the Bands Above 890 Mcs, 27 F.C.C. 359 (1959).

[33] *Id.* §148.

[34] *Id.* §147.

[35] Establishment of Policies & Procedures For Consideration of Application to Provide Specialized Common Carrier Servs. in the Domestic Public Point-to-Point Microwave Radio Serv., 19 F.C.C. 2d 870, §103 (1971).

[36] PHILIP L. CANTELON, THE HISTORY OF MCI: THE EARLY YEARS 30 (1993).

[37] Establishment of Policies And Procedures For Consideration of Application to Provide Specialized Common Carrier Services in the Domestic Public Point-to-Point Microwave Radio Service, 29 F.C.C. 2d 870 (1971).

transmission networks to private line services tailored to the requirements of the subscriber, taking advantage of the Commission's increasing tolerance with regard to the allowed types of services alternative providers could offer.[38]

The next challenge came with the advent of the computer industry, which began to liaise with the telecommunications industry synchronously to the birth of the alternative service providers in a way that allowed data processing services—the forerunners of the Internet—to emerge. What differentiated these "enhanced services"—as they were dubbed—from plain telephone service was that they "employ[ed] computer processing applications that act[ed] on the format, content, code, protocol or similar aspects of the subscriber's transmitted information."[39] Because the enhanced services were offered upon the telecommunications infrastructure, they were susceptible to becoming a bottleneck just like the existing telecommunications monopoly.

The Commission, having witnessed the positive effects of the steps it had taken earlier towards the opening-up of the telecommunications market, decided to prevent incumbents from exercising exclusive control over enhanced services. To achieve that, it adopted the *Computer Inquiries* orders,[40] whereby it required the separation of the infrastructure layer from the services layer, so that an entrant that wanted to offer an enhanced service was guaranteed indiscriminate access to the underlying transmission facilities.[41] This separation allowed for the explosion in the number of service providers, including Internet Service Providers (ISPs), for now they could offer as little as a news bulletin or as much as full-range telecommunication services.[42] In the words of MCI, "it is unlikely that the development of the Internet, and subsequent rapid innovation, would have occurred had the Commission's Computer II rules not ensured that the underlying transmission facilities were available to networking researchers and pioneering ISPs."[43]

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[38] The Commission was very cryptic about the scope of its SCC order. This resulted in an expansive interpretation to the benefit of the new alternative service providers. *See* Glen O. Robinson, *The Titanic Remembered: AT&T and the Changing World of Telecommunications*, 5 YALE J. ON REG. 517, 523 (1988) (reviewing GERALD R. FAULHABER, TELECOMMUNICATIONS IN TURMOIL: TECHNOLOGY AND PUBLIC POLICY (1987)).

[39] 47 C.F.R. § 64.702(a) (West, Westlaw through 2011 76 FR 30818).

[40] There were three Computer Inquiries in total. For the purposes of this paper we are only interested in Computer Inquiry II and III. *See* Second Computer Inquiry, *supra* note 21 (requiring telephone companies to offer enhanced services only through a structurally separated subsidiary while at the same time undertaking the obligation to open their infrastructure to any company that wanted to offer enhanced services); Amendment of Sections 64.702 of the Comm'n's Rules & Regulations (Third Computer Inquiry); Amendment of Sections 64.702 of the Comm'n's Rules and Regulations (Third Computer Inquiry); & Policy & Rules Concerning Rates for Competitive Common Carrier Servs. & Facilities Authorizations Thereof, Commc'ns Protocols under Section 64.702 of the Comm'n's Rules & Regulations, Report & Order, 104 F.C.C. 2d 958 (1986) (substituting the structural separation with comparably efficient interconnection (CEI) and Open Network Architecture (ONA) requirements).

[41] Robert Cannon, *Where Internet Service Providers and Telephone Companies Compete: A Guide to the Computer Inquiries, Enhanced Service Providers and Information Service Providers*, 9 COMMLAW CONSPECTUS 49 (2001) (describing how enhanced services can be offered under the layer separation scheme).

[42] JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: AMERICAN TELECOMMUNICATIONS POLICY IN THE INTERNET AGE 149 (2005).

[43] IP Enabled Servs.: MCI Comments, F.C.C. WC No. 04-36 at 16 (May 28, 2004).

To the dismay of many proponents of innovation, the Computer Inquiries obligations have been recently phased out with regard to Digital Subscriber Line (DSL). When the DSL technology was introduced, the Commission treated it as an enhanced *telecommunications* service, and therefore, Incumbent Local Exchange Carriers (ILECs) had to open their network (that is, offer DSL transmission services) to any competing ISP that wanted to enter the market.[44] Cable operators on the other hand grew largely unregulated, as they were not treated as common carriers, thus escaping the obligation to share their network.[45] Because this disparity in treatment was counter-intuitive and counter-productive,[46] the Commission decided to classify DSL as an information service, thus removing the obligation from telecommunications carriers to open their networks to competing DSL providers.[47]

Critics observed that putting ISPs in such a disadvantageous position was a threat to innovation itself, because ISPs acted as "middle-level competitors in the Internet economy" and as "engines for innovation in markets that we do not yet imagine."[48] While these fears may hold some truth, many justified the Commission's decision on the grounds that ISPs do not play the same role in the broadband world, where providers offer integrated services, as they did in the narrowband environment, and that today's cross-platform competition alleviates any oligopolistic tendencies that broadband service providers could otherwise have.[49]

The new classification of DSL as a broadband (information) service[50] did not, however, have any implications for the treatment of the services that were offered over DSL or any other type of broadband network. The fundamental principle of network neutrality in broadband networks still applied, and the Commission has been especially keen on keeping it in place,[51] regardless of whether affirmative steps were indeed needed

[44] Inquiry Concerning High-Speed Access to the Internet Over Cable & Other Facilities, 17 FCC Rcd. 4798, 4821 (2002); *see also* Deployment of Wireline Servs. Offering Advanced Telecomms. Capability, Various Petitions, Memorandum Op. & Order & Notice of Proposed Rulemaking, 13 FCC Rcd. 24012, 24028–30 (1998).

[45] Inquiry Concerning High-Speed Access to the Internet over Cable & Other Facilities, Declaratory Ruling & Notice of Proposed Rulemaking, 17 FCC Rcd. 4798, 4843 (2002); *see also* John T. Nakahata, *Broadband Regulation at the Demise of the 1934 Act: The Challenge of Muddling Through*, 12 COMMLAW CONSPECTUS 169, 171 (2004). The Supreme Court in the famous *Brand X* decision solidified the distinction. Nat'l Cable & Telecomm. Ass'n. v. Brand X Internet Servs., 545 U.S. 967 (2005).

[46] Robert Crandall et al., *The Empirical Case Against Asymmetric Regulation of Broadband Internet Access*, 17 BERKELEY TECH. L.J. 953, 954 (2002).

[47] Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, Report & Order & Notice of Proposed Rulemaking, 20 FCC Rcd. 14853, 14862–65 (2005).

[48] Mark A. Lemley & Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era*, 48 UCLA L. REV. 925, 941 (2001).

[49] NUECHTERLEIN & WEISER *supra* note 42, at 155–58.

[50] U.S. Telecom Ass'n v. FCC, 359 F.3d 554, 578 (D.C. Cir. 2004).

[51] When, for example, Comcast was found to be delaying BitTorrent traffic the Commission's response was prompt. *See* Kevin Martin, Formal Complaint of Free Press and Public Knowledge Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications; Broadband Industry Practices, WC Docket No. 07-52 (Press Statement), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-284286A2.pdf; *see also* SBC Commc'ns Inc. & AT&T Corp. Applications for Approval of Transfer of Control, 20 FCC Rcd. 18290, 18392 (2005); Verizon Commc'ns Inc. & MCI, Inc. Applications for

to safeguard it.[52] This way the Commission hoped "to encourage broadband deployment and preserve and promote the open and interconnected nature of the public Internet,"[53] because it doubted that competition alone was sufficient to keep the network neutral and affirmative steps were needed to prevent carriers from "inefficiently reduc[ing] innovation and investment in content, applications, and services, generating a suboptimal economic outcome."[54]

Discussions on the appropriateness of the Commission's actions are still ongoing, and the fact that the recently adopted Open Internet Order, which reiterated the Commission's insistence on network neutrality,[55] left most stakeholders unsatisfied proves that regulatory boundaries is a fine line to draw.[56] We now move to examine exactly how innovation works in the telecommunications environment, and what can be done to optimally continue the same path of innovation growth.

III. THE MECHANICS OF INNOVATION IN THE TELECOMMUNICATIONS INDUSTRY

It must be apparent by now that innovation has served as a powerful driving force throughout the history of telecommunications. My aim in the previous section was to prove that, seen in a historic continuum, the consistency with which innovation was at the forefront of regulatory and market developments was illustrative of its superior value. In this part, I set out to examine how innovation interacts with the telecommunications sector, emphasizing the particular factors that differentiate innovation in telecommunications from innovation in general. The purpose is to provide a framework that will support the discussion in the last Part (IV), where I examine regulatory proposals to maximize innovation.

Approval of Transfer of Control, 20 FCC Rcd. 18433, 18537 (2005) (terms the Commission set in order to approve the SBC/AT&T and Verizon/MCI mergers); Preserving the Open Internet Broadband Industry Practices, Report & Order, F.C.C. 10-201 (2010); *see generally* Mark Cooper, *The Importance of Open Networks in Sustaining the Digital Revolution*, *in* NET NEUTRALITY OR NET NEUTERING 111–23 (Thomas M. Lenard & Randolph J. May eds., 2006).

[52] The most vocal skeptic against network neutrality is professor Christopher Yoo. *See* CHRISTOPHER S. YOO, *Network Neutrality and Competition Policy: A Complex Relationship*, *in* NET NEUTRALITY OR NET NEUTERING *supra* note 51, at 27–28; Christopher S. Yoo, *Network Neutrality, Consumers, and Innovation*, 2008 U. CHI. LEGAL F. 179, 227 et seq. (2008); Christopher Yoo, *Network Neutrality After Comcast: Toward a Case-by-Case Approach to Reasonable Network Management*, *in* NEW DIRECTIONS IN COMMUNICATIONS POLICY 55 (Randolph J. May ed., 2009); *see also* Gerald R. Faulhaber & David J. Farber, *The Open Internet: A Customer-Centric Framework*, 4 INT'L J. OF COMM. 302 (2010).

[53] Appropriate Framework for Broadband Access to the Internet over Wireline Facilities et al. (Internet Policy Statement), 20 FCC Rcd. 14986, 14988 (2005).

[54] Preserving the Open Internet, Broadband Industry Practices, 74 Fed. Reg. 62,638, 62,642 (Nov. 30, 2009) (to be codified at 47 C.F.R. pt. 8).

[55] Preserving the Open Internet, Broadband Industry Practices Report & Order, GN Docket No. 09-191, 35 (2010).

[56] *See* Jennifer Valentino-DeVries, *Most of the Internet Grumbles About FCC Net Neutrality Rules*, WALL ST. J. BLOG, (Dec. 22, 2010 4:30PM), http://blogs.wsj.com/digits/2010/12/22/most-of-the-internet-grumbles-about-fcc-net-neutrality-rules/tab/print/.

A. The Interaction of Innovation and Market Forces in Telecommunications

In a firm's operation profit is often intuitively placed at the core. This comes as a result of a firm's very nature, which is to minimize transaction costs[57] and enable the scaling up of production.[58] The problem with treating firms as rational actors that merely seek to maximize profits is that this model, locked as it is in a static perspective, oversimplifies the market structure and fails to explain how markets evolve.[59] While at the microscopic level profit is indeed a firm's goal, markets at the macroscopic level advance through innovations and imitations thereof.[60] So for a firm to survive, it needs to be able either to come up with the next innovation that will grant it a competitive advantage, or to imitate more innovative firms at a pace that would at least keep it in the game.

This theory of innovation as the market's driving force was best voiced by Joseph Schumpeter, for whom firms compete mainly in terms of technological progress rather than on price.[61] The innovations that lead this progress are in turn rewarded by extraordinary profits, because the firm that introduced the innovation possesses monopoly power with regard to that innovation.[62] However, this monopoly position is transitory and lasts until imitators dilute the value of the innovation (e.g., by imperfect substitutes) or until the innovation is rendered obsolete (e.g., because the consumers' needs have changed), at which point the next wave of innovation will come.[63] This cycle exhibits regularities, which consist of the introduction of an innovation, the imitation of the innovation by competitors, the exhaustion of the innovation's value, and the appearance of a new innovation.[64]

From the preceding analysis we can distinguish two reasons why the telecommunications sector offers particularly favorable conditions for innovation to thrive. The first refers to the innovation cycles. Technological progress comes "through long periods of incremental change punctuated by revolutionary breakthroughs" and can be "fruitfully characterized as a sociocultural evolutionary process of variation, selection, and retention."[65] The more rapid the succession of these steps, the more innovation will take place within a given timeframe. Telecommunications' technical nature leads to

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[57] Ronald Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).

[58] GERHARD ROSEGGER, THE ECONOMICS OF PRODUCTIONS AND INNOVATION: AN INDUSTRIAL PERSPECTIVE 89–90 (2d ed. 1986).

[59] Richard R. Nelson & Sidney G. Winter, *Neoclassical v. Evolutionary Theories of Economic Growth: Critique and Prospectus*, 84 ECON. J. 886, 887–90 (1974) (presenting the neoclassical theory and its shortcomings).

[60] Chris Freeman, *Innovation and Growth, in* THE HANDBOOK OF INDUSTRIAL INNOVATION 78, 78–80 (Mark Dodgson & Roy Rothwell eds., 1994).

[61] JOSEPH A. SCHUMPETER, THE THEORY OF ECONOMIC DEVELOPMENT 57 (10th ed. 2004).

[62] MORTON I. KAMIEN & NANCY L. SCHWARTZ, MARKET STRUCTURE AND INNOVATION 9–11 (1982).

[63] *See* JON SUNDBO, THE THEORY OF INNOVATION: ENTREPRENEURS, TECHNOLOGY AND STRATEGY 26 (1998).

[64] Ross Brennan, *Evolutionary Economics and the Markets-as-networks Approach*, 35 INDUS. MARKETING MGMT. 829, 831–32 (2006).

[65] Philip Anderson & Michael L. Tushman, *Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Chang*e, 35 ADMIN. SCI. Q. 604, 605 (1990).

greater technological dynamism, which in turn is tied with faster product and service development.[66] At the same time, the output of innovation in telecommunications is often also technical in nature, which intensifies the feedback loop in the innovation process.

In highly technical industries like telecommunications, knowledge as an input value is relatively more important than in other industries because "for high information content goods a larger fraction of the innovation costs will be pure [research and development (R&D)] costs."[67] Therefore, the easier it is to generate and share information, the lower the cost of innovation becomes. And indeed, today's context of information abundance makes the exchange of information easier and cheaper. As a result the imitation of information-centered innovations is facilitated and so the innovation cycle frequency increases.[68] This observation is without prejudice to the fact that firms often *choose* not to cooperate or share knowledge. All I am noting here is that cooperation in highly technical industries, where knowledge takes up a larger share of the innovation cost compared to non-technical industries, is easier.

Additionally, the relative ease with which consumers can switch from one firm to another calls for rapid and continuous offer of new products and services to ensure customer lock-in.[69] In fact, the closer to the technological frontier companies remain (and thus closer to consumer preferences), the more probable it is that they will try to keep up with innovative competition, because the expected payoffs from investment in R&D (as well as other components of innovation, e.g., capital and labor) are higher compared to technologically laggard companies, which are so far from the high-end frontier that the benefits of trying to catch up with innovation will usually cost more than the profits they will rip from the added innovations.[70]

The second reason why the telecommunications environment is particularly favorable to innovation is grounded in the networked nature of telecommunications. To understand why, we have to look at the relationship between innovation and competition, which from the industrial organization perspective is the primary determinant of the intensity and reward rate of innovation.[71] As mentioned earlier, the principal reward of an

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[66] Eric H. Kessler & Alok K. Chakrabarti, *Innovation Speed: A Conceptual Model of Context, Antecedents, and Outcomes*, 21 ACAD. MGMT. REV. 1143, 1156–57 (1996).

[67] Thomas F. Cooley & Mehmet Yorukoglu, *Innovation and Imitation in an Information Age*, 1 J. EUR. ECON. ASS'N. 406, 407 (2003).

[68] *Id*. *passim*; *see also* Hokky Situngkir, *Evolutionary Economics Celebrates Innovation and Creativity-Based Economy*, 7 ICFAI U. J. OF KNOWLEDGE MGMT. 7 (2009).

[69] Guy Gellatly & Valerie Peters, *Understanding the Innovation Process: Innovation in Dynamic Service Industries* 20 (Statistics Canada, Research Paper No. 127, 1990).

[70] Philippe Aghion et al., *The Effects of Entry on Incumbent Innovation and Productivity*, 91 REV. OF ECON. & STAT. 20, 20 (2009).

[71] Competition is the general framework in which innovation is studied, but changing basic assumptions about the conditions of the market or the nature of the particular innovation under scrutiny can yield significantly different results. Examples of factors that have a bearing on the relationship between competition and innovation are: whether an innovation is drastic or incremental, whether imitation is easy, whether the cost of R&D is paid upfront or gradually, the market share of each firm, the credibility of a competitive threat, and others. *See* Raymond de Bondt & Jan Vandekerckhove, *Reflections on the Relation Between Competition and Innovation*, J. IND. COMPET. TRADE (forthcoming, published online July 2010).

innovation is the monopoly rents the innovating company will extract for as long as it retains the monopoly position in the market with regard to that innovation. *Some* competition will positively affect innovation rates, because it fuels the innovation cycle that will lead to the depreciation of the innovation by inducing other competing firms to imitate or leapfrog the original imitator.[72] *Excessive* competition, however, may have an adverse effect on innovation rates because it results in rapid depreciation of an innovation and accordingly diminished rents for innovating companies.[73] Efforts to reconcile the two extremes have led to an inverted U-shaped curve where initially the fear of preemption by a competitive firm increases competition, but after a certain point excessive competition diminishes the margin of profit, and with it the incentives to innovate. The latter is especially true when the innovation is risky and imitation is easy, in which case firms simply choose to wait.[74]

Interestingly, all other factors equal, what distinguishes the telecommunications industry from other highly competitive industries is the network effects it exhibits. Because within networks, an innovation's value grows with the number of nodes that use it,[75] even if an imitation is later introduced in the network the lead-time advantage of the original innovation magnified by network effects still places it in an advantageous position. Consider the classic example of instant messaging (IM). When AOL released AIM (its standalone IM system) in 1997 it counted already almost 30 million subscribers, who were at the same time potential AIM users.[76] Within the following two years Yahoo! and Microsoft joined the IM race, but by that time AIM was already by far the dominant IM platform.[77] Because of the lack of interoperability between AIM and other messengers,[78] users were more inclined to prefer AIM even after the introduction of competing IM programs, which may have been better in some respects, because the chances were that their friends would also be using AIM. Of course, network effects are not the only factor that affects an innovation's success (they may not even be the defining factor in some cases).[79] The suggestion here is simply that, unlike other industries where network effects do not play a significant role and hence the lead-time advantage is

[72] Philippe Aghion et al., *Competition, Imitation and Growth with Step-by-step Innovation*, 68 REV. OF ECON. STUD. 467, 470 (2001).

[73] *See* KAMIEN & SCHWARTZ, *supra* note 62, at 24-31.

[74] Philippe Aghion, *Competition and Innovation: An Inverted-U Relationship*, 120(2) Q. J. ECON. 701, 702–03, 710–711 (2005).

[75] *See* Economides, *supra* note 8.

[76] In fact, AIM was so dominant that its position in the market was scrutinized as part of AOL's merger deal with Time Warner. *See* Catherine Holahan, *Will Less Be More for AOL?*, BUSINESSWEEK, July 31, 2006, http://www.businessweek.com/technology/content/jul2006/tc20060731_168094.htm.

[77] Gerald Faulhaber, *Network Effects and Merger Analysis: Instant Messaging and the AOL–Time Warner Case*, 26 TELECOMM. POL'Y 311 (2002).

[78] Tests for interoperability between AIM and other programs started a few years after MSN Messenger and Yahoo! Messenger were popularized around 2001. *See AOL Time Warner Inc.: Messaging Interoperability to Be Tested in Summer*, WALL ST. J., July 24, 2001, at B8.

[79] *See, e.g.*, Michael L. Katz & Carl Shapiro, *Technology Adoption in the Presence of Network Externalities*, 94 J. OF POL. ECON. 822 (1986) (arguing that a sponsored technology may become dominant even if it was introduced later than competing non-sponsored technologies).

attenuated, in telecommunications the lead-time advantage coupled with network effects provides greater assurance to the innovator that he will recoup the cost of his innovation.

Similarly, in the presence of network externalities, the telecommunications industry finds itself under pressure to adopt standards so as to facilitate communication within and between networks in order to maximize the value of the network(s).[80] A standard, in turn, serves as the basis of a network's power, because a standard controls the exclusion or inclusion from and into the network.[81] Therefore, the firm that moves first to set the standard upon which the network will develop possesses leadership power. As a consequence, in telecommunication networks innovators can recoup the cost of their investments despite fierce and rapid competition, because the edge granted by priority of the standard-setting process can give them the power to exclude, discourage, or hinder competing imitators.[82]

B. Regulatory Choices and Innovation Growth

The transition of telecommunications from a regulated monopoly to a competitive environment did not come unconditionally; its nature as a *public utility* imposed a duty on the Commission and Congress to foster competition with the public interest in mind.[83] Assigning a specific content to the public interest can be tricky. Though one can generally say that the safeguarding of the public interest consists of protecting consumers from the abuses of market imperfections,[84] a more specific delineation of the public interest is almost impossible both because of its virtually all-inclusive meaning, and because of its highly dynamic evolution.[85] This makes it hard for a singular and static regulatory goal to suffice in serving the public interest in the long run.

On the contrary, broader goals, like competition and innovation, function as a framework, driving (and driven by) both technological change and market orientation, which taken together best approach the ever-changing needs of the public.[86] Thus, unlike fixed monothematic policies, a framework goal allows markets and regulators to dynamically adjust their stance toward societal and technological developments, and better address the diverse needs of consumers.

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[80] Kenneth W. Abbott & Duncan Snidal, *International 'Standards' and International Governance*, 8 J. OF EUR. PUB. POL'Y 345, 350 (2001).

[81] MANUEL CASTELLS, COMMUNICATION POWER 42-43 (2009).

[82] Marc T. Austin & Helen V. Milner, *Strategies of European Standardization*, 8 J. OF EUR. PUB. POL'Y 411, 413–17 (2001); *see also* Emanuele Tarantino, *Inefficient Practices in Standard Setting Organizations: A Model of Exclusion with Complementary Inputs and Hold-up*, *available at* http://ssrn.com/abstract=1442503.

[83] I take a uniform approach to the public interest theory, but many spin-offs and variations exist, making it hard to pinpoint where one theory ends and another begins. *See* ROBERT B. HORWITZ, THE IRONY OF REGULATORY REFORM 25–27 (1989).

[84] CHARLES F. PHILLIPS, JR., THE REGULATION OF PUBLIC UTILITIES 174 (2d. ed. 1988).

[85] *See* HORWITZ, *supra* note 83, at 22–25.

[86] Hanne Harmsen et al., *Why Did We Make That Cheese? An Empirically Based Framework for Understanding What Drives Innovation Activity*, 30 R&D MANAG. 151, 151–52 (2000).

So far regulators have focused on increasing competition[87] often with the view that more competition would lead to higher innovation rates. This belief is generally correct: while economists are divided as to the effect of competition on the incentives of the individual firm,[88] there seems to be consensus that on a market-wide level competition is positively correlated with innovation, as the overall effect of increased interactions of a large number of actors prevails over the discouraging effect of the competition among them.[89] The positive effects of competition aside, innovation should become a separate (and important) regulatory goal, for innovation supersedes competition in certain respects that deserve attention.

First, innovation, unlike competition, is not market-specific. A local ISP in Los Angeles can imitate an innovation developed by a local ISP in New York, yet the two firms are not in any kind of competition. The explosive growth of ISPs between 1996 and 2000 (while the *Computer Inquires* were still in force) might not suggest anything about competition, as most of them were local, but a population of more than 5000 ISPs may in fact have contributed to the evolution and consolidation of several models of services, like the walled-garden services or billing methods (e.g., the introduction of flat-rate monthly fees even for dial-up connections).[90]

Second, innovations can occur not only as a result of directly competing actors but also as a result of the creative input of end users, intermediaries, and suppliers.[91] The combined forces of all these actors create in effect a "vertically-integrated form of research and development"[92] whose internal processes are stimulated by innovation among the partaking actors. Progress in the telecommunications industry is dependent

[87] For example, the purpose of the Telecommunications Act of 1996, which epitomizes the policy goals and debates of the preceding decades, is "[t]o promote competition and reduce regulation in order to secure lower prices and higher quality services for American telecommunications consumers and encourage the rapid deployment of new telecommunications technologies." 47 U.S.C. pmbl. (1996).

[88] As Cohen and Levin note "[p]erhaps the most persistent finding concerning the effect of concentration on R&D intensity [which the authors take as a measurement of innovation rate] is that it depends upon other industry-level variables." Wesley M. Cohen & Richard C. Levin, *Empirical Studies of Innovation and Market Structure*, *in* HANDBOOK OF INDUSTRIAL ORGANIZATION (VOL. 2) 1059, 1076 (Richard Schmalensee and Robert Willig eds., 1989). In general, one school of thought following Schumpeter argues that innovation would be harmed, because monopoly is a necessary precondition for innovation, as only monopoly provides the certainty a firm needs before it decides to bear the cost of innovation; on the other end of the spectrum Arrow's supporters counterclaim that competition increases innovation as firms race to preempt their competitors. For an up-to-date survey of the relationship between competition and innovation *see* Cátia Felisberto, *The Relationship Between Competition and Incumbent's Innovation*, J. IND. COMPET. TRADE (forthcoming).

[89] Richard Blundell et al., *Market Share, Market Value and Innovation in a Panel of British Manufacturing Firms*, 66 REV. ECON. STUDIES 529 (1999); Thomas Lyon & Haizou Huang, *Asymmetric Regulation and Incentives for Innovation*, 4 IND. & CORP. CHANGE 769 (1995).

[90] FCC, *The Digital Handshake: Connecting Internet Backbones 44* (OPP Working Paper No. 32, 2000), *available at* http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp32.pdf.

[91] ERIC VON HIPPEL, THE SOURCES OF INNOVATION 11–42 (1988); *see also* DAVID C. MOWERY & NATHAN ROSENBERG, TECHNOLOGY AND THE PURSUIT OF ECONOMIC GROWTH 205–19 (1989).

[92] Guy Gellatly & Valerie Peters, *Understanding the Innovation Process: Innovation in Dynamic Service Industries* 13 (Statistics Canada, Research Paper No. 127, 1999).

upon innovations in related but distinct industries.[93] For example, telecommunications firms compete at the Internet services market, but the variety and quality of services they provide depends on outside firms that develop the technologies upon which telecommunications rely, namely fiber optics, DSL, etc. A policy that simply aims at increasing the number of service providers will probably lead to lower prices and greater penetration, but it is less likely that it will advance a new technology. This is the basic critique of non-facilities-based competition: service providers that rely on the incumbent's infrastructure do, in essence, nothing more than resell the incumbent's services, thus providing a "completely synthetic" form of competition.[94] On the contrary, abandonment of wholesale access as an option of entry may force competitors to invest in their own technologies and networks.[95] This way innovation will happen not only in the services layer, but in the underlying infrastructure as well.

The interworking of this expanded list of actors is further augmented by the fact that they often exist in networks. Networks maximize the interactions between the constitutive nodes by generating a "feedback loop" between the introduction of input elements in the network and the output elements of the processes that take place within the networks.[96] As a result, the value of the input elements—be it capital, labor or intellect—is amplified as each innovation element is exposed to the maximum number of potential adopters, modifiers, or imitators. This is important because the innovation process does not happen in vitro nor is it usually the brainchild of a "lone genius," but rather is more accurately described as the confluence of the creative forces of a network of actors (who may even be competing), each of whom contributes his own share.[97] Take the example of how the backbone protocol of the Internet, TCP/IP, was developed: the brainchild of Vinton Cerf and Bob Cahn, TCP/IP started as a military project under the auspices of the Defense Advanced Research Projects Agency (DARPA) in the mid–1970s, but was quickly handed off to the Internet Activities Board (IAB) in 1983 (IAB was later renamed the Internet Architecture Board).[98] The development of the TCP/IP suite in the frames of IAB was opened up to a broad network of engineers once DARPA spun off its military-oriented project (MILNET), thus allowing the Internet to acquire a

[93] *See id*. at 10.

[94] U.S. Telecom Ass'n v. FCC, 290 F.3d 415, 424 (D.C. Cir. 2002).

[95] DANIEL F. SPULBER & CHRISTOPHER S. YOO, NETWORKS IN TELECOMMUNICATIONS: ECONOMICS AND LAW 259–60 (2009).

[96] *See* MANUEL CASTELLS, THE INFORMATION AGE: ECONOMY, SOCIETY AND CULTURE – THE RISE OF THE NETWORK SOCIETY 31 (2d ed. 2000) (claiming that the human mind in networks is "a direct productive force, not just a decisive element of the production system"). *See also* KEVIN KELLY, OUT OF CONTROL: THE NEW BIOLOGY OF MACHINES, SOCIAL SYSTEMS AND THE ECONOMIC WORLD 26 (1995) ("the only organization capable of unprejudiced growth, or unguided learning, is a network. All other topologies limit what can happen . . . . A distributed, decentralized network is more a process than a thing."); Andrew Murray, *Symbiotic Regulation*, 26 J. MARSHALL J. COMPUTER & INFO. L. 207, 224–27 (2008).

[97], INDUSTRIAL TECHNOLOGICAL DEVELOPMENT: A NETWORK APPROACH 3 (Hakan Hakansson ed., 1987); Jan Fagerberg, *Schumpeter and the Revival of Evolutionary Economics: An Appraisal of the Literature*, 13 J. EVOL. ECON. 125, 141–43 (2003).

[98] Barry M. Leiner et al., *A Brief History of the Internet*, 39 ACM SIGCOMM COMP. COMM. REV. 22, 29 (2009).

universal character.[99] Indeed, today "any interested person can participate in the work of [the Internet Engineering Task Force (IETF)[100]], know what is being decided, and make his or her voice heard on the issue."[101] Briefly put, the Internet runs largely based on the voluntary collaboration of an international network of unaffiliated engineers, for whom competition plays no role in the process.

Of course it would only make sense to care about a large network of actors, many of whom would inevitably be small players, if they could materially contribute to the innovation process. The traditional Schumpeterian hypothesis would suggest that larger firms are better positioned for innovation because they have greater financial capacity to fund the increasing cost of innovation, they can more easily obtain economies of scale, and they have a superior ability to exploit the output of the innovative process.[102] However, despite these obvious advantages, a large body of literature that spans fifty years has not been able to offer conclusive results that this hypothesis is true.[103] There is on the contrary *some* evidence that small independent firms account for at least a large part of the most disruptive innovations,[104] and that there might even be a negative correlation between innovation and concentration,[105] and there is *rich* evidence that small firms and individuals account for almost half of U.S. inventions.[106] But even if we concede to the Schumpeterian reservations with regard to small firms' ability to innovate, the Schumpeterian paradigm of innovation, whereby each separate firm bears the cost of its own R&D, no longer dominates economic activity. This comes as a result of a multitude of factors, such as the mobility of knowledge, private venture capital investments, the endogenous pressure of the increasing cost of R&D,[107] and—when it comes specifically to telecommunications—the modularity of networks.[108]

Accordingly, a large number of actors change the decision-making system. Lowering the barriers to entry and the concomitant rise of smaller players will result in a

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[99] *Id*. at 28.

[100] IETF is part of the Internet Society, which succeeded the Internet Architecture Board.

[101] Harald Alvestrand, *RFC 3935: A Mission Statement for the IETF*, § 1, INTERNET ENGINEERING TASK FORCE (Apr. 2004), http://www.ietf.org/rfc/rfc3935.txt.

[102] Roy Rothwell & Mark Dodgson, *Innovation and Size of Firm*, *in* THE HANDBOOK OF INDUSTRIAL INNOVATION 310, 312 (Mark Dodgson & Roy Rothwell eds., 1994).

[103] *Id*. *passim*; KAMIEN & SCHWARTZ, *supra* note 62, at 75–84.

[104] Rajesh K. Chandy & Gerard Tellis, *The Incumbent's Curse? Incumbency, Size, and Radical Product Innovation*, J. OF MARKETING, VOL. 64, July 2000, at 1.

[105] Gunnar Eliasson, *Deregulation, Innovative Entry and Structural Diversity as a Source of Stable and Rapid Economic Growth*, 1 J. EVOL. ECON. 49, 54 (1991).

[106] Peter N. Detkin, *Leveling the Patent Playing Field*, 6 J. MARSHALL REV. INTELL. PROP. L. 636, 637 (2007).

[107] Henry W. Chesbrough, *The Era of Open Innovation*, *in* MANAGING INNOVATION AND CHANGE 127, 128–30 (David Mayle ed., 2006); HENRY W. CHESBROUGH, OPEN BUSINESS MODELS: HOW TO THRIVE IN THE NEW INNOVATION LANDSCAPE 52–79 (2006).

[108] William P. Rogerson, *The Regulation of Broadband Telecommunications, the Principle of Regulating Narrowly Defined Input Bottlenecks, and Incentives for Investment and Innovation*, 2000 U. CHI. LEGAL F. 119, 119–27 (2000).

polyarchical decision-making architecture (as opposed to a hierarchical architecture).[109] The difference between the two systems is that in polyarchies any single actor's approval is enough for the innovation itself to be approved, whereas in hierarchies an innovation has to climb up the entire pyramid of involved actors or to pass a single bottleneck to get approved.[110] As a result, more innovations are approved in the polyarchic system, but at the same time, because some of them will be unsuccessful, more false negative innovations are also approved. The question for regulators now is whether the telecommunications system is an error-tolerant environment; in other words, whether the cost of the multiplication of false negative innovations produced by the increased number of players will be greater than that of a system with fewer actors, which produces fewer false negative—but also fewer false positive—results.[111]

The answer is far from clear, but consider the following points. In a highly stable environment, where the conditions of the production process are fixed, a hierarchy would normally have a greater success rate because it possesses enough knowledge to avoid false positive errors.[112] On the contrary, in a fast-paced and highly unpredictable environment, a polyarchy has better chances of success because we expect that the screening process will be faulty due to lack of adequate information.[113] Thus, the architecture that implements a more lenient screening process (i.e., the polyarchic system) will yield better results. Hence, in the telecommunications sector, with its high degree of volatility and fast rates of progress, it is highly doubtful that a small number of big players have an advantage in innovation output.[114]

Polyarchies are also associated with potential economic inefficiencies, as they tend to allow more false negatives. This danger, however, can be eased by lowering the cost of innovation, thus reducing the social and economic waste of false negative errors. The lower cost can be attributable to open innovation, network sharing, or to the mechanics of knowledge production: since knowledge is built upon previous knowledge, centralized hierarchical systems that tend to restrict information flow increase the cost of producing more knowledge.[115] Most importantly, though, a distributed system of players

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[109] Raaj K. Sah & Joseph E. Stiglitz, *The Architecture of Economic Systems: Hierarchies and Polyarchies*, 76 AM. ECON. REV. 716, 716 (1986).

[110] Patrick Bolton & Joseph Farrell, *Decentralization, Duplication and Delay*, 98 J. POL. ECON. 803, 803 (1990).

[111] *Cf.* Sah & Stiglitz, *supra* note 109, at 719.

[112] *See* Tim Wu, *Intellectual Property, Innovation and Decentralized Decisions*, 92 VA. L. REV. 123, 130–31 (2006).

[113] *See* Friedrich A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 519–20 (1945).

[114] One of the reasons why some academics oppose network neutrality is that a fixed and rigid policy that would mandate equal treatment of all content would preclude dynamic technological change and advances in any direction that violates the net neutrality principle, but at the same time it offers other advantages. *See* Christopher S. Yoo, *Would Mandating Broadband Network Neutrality Help or Hurt Competition? A Comment on the End-to-End Debate*, 3 J. ON TELECOMM. & HIGH TECH. L. 23, 44–47, 58–59 (2004).

[115] Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29, 32–35 (1991).

probably has higher chances of better utilizing the available information—a key ingredient to innovation.[116] As Hayek writes,

> [t]he economic problem of society is thus not merely a problem of how to allocate "given" resources—if "given" is taken to mean given to a single mind which deliberately solves the problem set by these "data." It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge which is not given to anyone in its totality.[117]

Thus in a decentralized polyarchic system chances are that knowledge will be utilized by anyone who is in the best position to exploit it.

It should not be assumed that polyarchies mean chaos or anarchy. Nor am I advocating a socialist view of telecommunications. The purpose of this part has been to show that there are significant benefits to innovation flowing from a large pool of actors. As a result, if a regulatory choice can be made in favor of more players, which at the same time does not chill the activity of the few large players, it should be advanced. The next part addresses this conundrum.

IV. INNOVATION-ORIENTED REGULATION

This part builds upon the innovation theory presented previously and examines the role of regulation in maximizing it. As explained, innovation here is understood to benefit more when it is the outcome of a decentralized and un-concentrated industrial organization system. Along those lines, it is important to note in advance that this system may not be consistent with other priorities of industrial organization. Most importantly, it may well depart from the static efficiency ideal that drives much of economic analysis, and in fact many economists would agree that static efficiency and innovation maximization (dynamic efficiency) are often irreconcilable.[118] Both, however, are necessary for economic progress.

Innovation as understood here is not about static efficiency. A static efficiency approach would endorse a large firm, even one bordering monopoly size, if that meant more efficient production, due to, for example, economies of scale (for which

[116] I qualify this statement because the performance of a decision-making system is not only dependent on the number of decision-makers but also on their quality. It is suggested, for example, that a good hierarchy is better than a good polyarchy, but a bad hierarchy is worse than a bad polyarchy. *See* Raaj K. Sah, *Fallibility in Human Organizations and Political Systems*, 5 J. ECON. PERSP. 67, 69–71 (1991).

[117] Hayek, *supra* note 113, at 519–20.

[118] *See* Pankaj Ghemawat & Joan E. Ricart I Costa, *The Organizational Tension between Static and Dynamic Efficiency*, 14 STRATEGIC MGT J. 59 (1993).

telecommunications is a perfect example).[119] To the contrary, innovation-friendly regulation would tolerate less efficient use of the available resources in the short run to achieve welfare benefits in the long run in the form of technological progress. Why a decentralized system of diverse actors is better positioned to achieve these long-run benefits was answered in Part III. In essence, multiplicity and heterogeneity may well be better than strict static efficiency for the purposes of innovation.[120] This Part completes the discussion by suggesting how to reach the desired state of multiplicity and heterogeneity.

With this in mind, the first objective of innovation-oriented regulation is to seek to facilitate entry because, due to the structure of the telecommunications industry (large sunk costs, high entry barriers, network effects), competition alone may be too weak to provide the initial thrust. The second objective is to make regulation flexible so that once entrants strengthen their position in the market, authorities can withdraw or offer offsetting incentives, allowing both incumbents and competitors to be guided solely by market forces. The overall design is a few years of managed competition and suppressed incentives for a properly working competitive market in the long run.

A. Balancing Interests in a Competitive Market

Normally only a small number of players are expected to be able to participate in the telecommunications market, due to the very high cost of entry.[121] An oligopoly is preferable to a monopoly as it can at least act somewhat competitively,[122] but oligopolies are still very restrictive in terms of the number and diversity of players they allow. As explained previously in this Article,[123] innovation generally benefits from an enlarged pool of diverse actors, and consequently an innovation-oriented policy should aim at increasing the number of players. However, the special structure of the telecommunications industry (high fixed and sunk investments, wasteful duplication, economies of scale and scope, network effects) presents significant challenges for entrants, which brings regulators face to face with a dilemma: should they facilitate entry

[119] *See* W. KIP VISCUSI, JOSEPH E. HARRINGTON, JR. & JOHN M. VERNON, ECONOMICS OF REGULATION AND ANTITRUST 85–86 (2005).

[120] *See* the classic formulation by E.H. Chamberlin, *Product Heterogeneity and Public Policy*, 40 AM. ECON. REV. 85, 89–90 (1950) ("But unless it can be shown that the loss of satisfaction from a more standardized product . . . is less that the gain of producing more units, there is no 'waste' at all, even though every firm is producing to the left of its minimum point." *Id*.).

[121] *See* Gerald R. Faulhaber & Christiaan Hogendorn, *The Market Structure of Broadband Telecommunications*, 48 J. INDUST. ECON. 305, 321 (2000).

[122] In fact, the smaller the number of players, the greater the effect of new entrants on competition. *See* Timothy F. Bresnahan & Peter C. Reiss, *Entry and Competition in Concentrated Markets*, 99 J. POL. ECON. 977, 996 (1991) (concluding that most of the increase in competition comes with the entry of the second and third firm). In the telecommunications field this means that the gains from adding one extra modality of service delivery—say, wireless—would probably be quite high, because at present only two technologies (telephone and cable) dominate broadband).

[123] *See supra* Part III.A–B.

by promulgating sharing obligations—and if so, what kind of sharing obligations—or should they stay out of the market, hoping that competition will suffice?

As to the type of sharing, for my purposes here I distinguish between two types: a) the offer by a network owner of his network services to competitors at wholesale prices for them to resell and b) the offer by a network owner of network elements to competitors at regulated prices for them to use as part of their own network. The latter is commonly referred to as unbundling[124] and opens the door to facilities-based competition, unlike mere wholesale access, where the competitor simply resells the network owner's services. Unbundling has better chances of increasing overall innovation than wholesale access, because it allows innovation to take place at the physical layer too, thus nurturing a more genuine form of competition.[125] The qualitative difference between innovation taking place on all layers and innovation being restricted only on the upper layers is not insignificant. Both intermodal and intra-modal competition can result in lower prices, more penetration and greater service diversity,[126] but the very nature of new modalities of communication, offered only in the frames of intermodal competition, opens new possibilities, and advances communications technology to new levels. For example, wireless broadband networks can spur innovations that relate to mobility (e.g., geolocation tools and services), something that is impossible with fixed wireline networks.

Few would disagree that vibrant facilities-based innovation is preferable. Harder is the issue of which method is better positioned to achieve this result: regulatory forbearance or regulatory intervention in the form of network sharing. Both sides have elaborate arguments that have been on the table for many years now, and the deployment of next-generation networks renders them timely again.

Established players favor regulatory forbearance, because first—they argue—there is no market failure to rectify: the rationale that the last mile is a natural monopoly[127] is nowadays untrue due to viable competition from cable, wireless and

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[124] *Cf.* Telecommunications Act of 1996, 47 U.S.C. § 251(c)(3) (2006).

[125] For the benefits of choosing infrastructure competition, *see* Walter S. Baer, *Telecommunications Infrastructure Competition*, 19 TELECOMM. POL'Y 351, 351–60 (1995); *see also* Robert W. Crandall et al., *Bandwidth for the People*, 127 POL'Y REV. 67, 72 (2004).

[126] Indeed, many countries where cable networks were never deployed and where intermodal competition therefore remained marginal for many years (with satellite usually serving as the only alternative) now boast highly developed broadband networks. For an international review, see GLOBAL BROADBAND BATTLES: WHY THE U.S. AND EUROPE LAG WHILE ASIA LEADS (Martin Fransman, ed., 2006).

[127] The last mile (also known as local loop or access network) is the part of the network that extends from the user's premises to the first network edge, usually the network operator's Central Office. *See* RAY HORAK, TELECOMMUNICATIONS AND DATA COMMUNICATIONS HANDBOOK 430–31 (2007). The last mile is the hardest and most expensive part of the network infrastructure to replicate, because it entails acquiring rights of access, digging up trenches, deploying wires, etc. For the cost structure of the last mile see ITU Cost Analysis for DSL Networks (ICT Regulation Toolkit Practice Note), *available at* http://www.ictregulationtoolkit.org/en/PracticeNote.aspx?id=2899; ITU, Cost Analysis for Cable Networks (ICT Regulation Toolkit Practice Note), *available at* http://www.ictregulationtoolkit.org/en/PracticeNote.aspx?id=2973; ITU, Cost Analysis for FTTH (ICT

satellite.[128] Second, they claim that opening up their network to competitors lessens their incentives to invest, because they know a priori that they will be forced to share their investment with competitors, who will in turn drive down the margins for profit.[129] Third, they argue that allowing firms to reserve their network infrastructure exclusively for their own services enables them to better exploit the benefits of vertical integration,[130] free from costly interference of other network operators.[131] Fourth, they refute the dangers of oligopolistic or anticompetitive behavior on the grounds that it is not always in their best interest to block providers of complimentary services. Network operators act as platforms, which draw value from the applications and content that are built upon them.[132] These "indirect network externalities" raise the value of the network, providing a motive for network owners to make their networks as open and accessible as possible and create favorable conditions for independent innovation.[133]

These arguments are generally valid but open to rebuttal. To begin with, the "last mile" market is not uniformly competitive, as choice for voice is limited usually to two or three providers (telephone, cable, and/or wireless), and broadband data connectivity is limited to two providers at best as even the Commission admits (DSL and cable; wireless cannot at present be considered an adequate substitute for broadband data connectivity, but the situation is changing rapidly).[134] As a result, the market structure is better characterized as oligopolistic and not as fully competitive. Second, the link between unbundling and lower investment incentives is not always strong. Empirical studies seem to be able to prove an inverse relationship between unbundling and investment in the U.S.

Regulation Toolkit Practice Note), *available at* http://www.ictregulationtoolkit.org/en/PracticeNote.aspx?id=2974.

[128] *See* SPULBER & YOO, *supra* note 95, at 241–44, 348–51.

[129] Robert S. Pindyck. *Mandatory Unbundling and Irreversible Investment in Telecom Networks*, 6 REV. OF NETWORK ECON. 274, *passim* (2007); Tim Wu, *The Broadband Debate: A User's Guide*, 3 J. TELECOMM. & HIGH TECH. L. 69, 75–77 (2004).

[130] Vertically integrated telecommunications firms can deliver a service at lower price or better quality, because they can manage the complementarities among all the different elements in an optimal way and because vertical integration reduces transaction costs. *See* James B. Speta, *Handicapping the Race for the Last Mile?: A Critique for Open Access Rules for Broadband Platforms*, 17 YALE J. ON REG. 39, 82 (2000); Andy C. M. Chen, *Procompetitive Theories of Vertical Control*, 50 HASTINGS L.J. 573, 590–92 (1999). *See generally* RICHARD A. POSNER, ANTITRUST LAW 223–29 (2d ed. 2001); C. Scott Hemphill, *Network Neutrality and the False Promise of Zero-Price Regulation*, 25 YALE J. ON REG. 136, 148, 152–59 (2008); VISCUSI ET AL., *supra* note 119, at 241–42; LAWRENCE A. SULLIVAN, HANDBOOK OF THE LAW OF ANTITRUST 431–63 (1977).

[131] See William R. Drexel, *Telecom Public Policy Schizophrenia: Schumpeterian Destruction Versus Managed Competition*, 9 VA. J.L. & TECH 1, 50–53 (2004), for a first-hand review of the burden that unbundling places on network operators.

[132] Van Alstyne et al., *Platform Networks—Core Concepts* (MIT Ctr. for Digital Bus. Working Paper No. 232, 2007).

[133] *See* Speta, *supra* note 130, at 76.

[134] *See* FCC NATIONAL BROADBAND PLAN, *supra* note 3, at 37 ("Given that approximately [ninety-six percent] of the population has at most two wireline providers, there are reasons to be concerned about wireline broadband competition in the United States. Whether sufficient competition exists is unclear and, even if such competition presently exists, it is surely fragile.").

market,[135] but data collected from other markets are more inconclusive.[136] It is also true that for unbundling to work, fine regulatory tuning is required as evidenced by the mixed stories of success around the world. Where the access price was set at the right levels,[137] or where control mechanisms were adopted to ease the regulatory burden,[138] regulators managed to bring about the desired results. In any case the investment disincentive argument has a short life span, estimated at around two years, since, naturally, investments cannot be held back forever.[139] Hence, it may be the case that it is not the theoretical underpinnings of the sharing theory that are flawed, but rather the implementation of the theory, and therefore it should not be dismissed right away. Indeed, countries like Germany and Japan provide exemplary illustrations of how unbundling did not discourage investment.[140]

Moreover, even if sharing obligations are promulgated from the beginning of the investment, the investing firm may be able to leverage a first mover advantage, which will allow it to recoup some of the cost of the investment under (quasi-) monopolistic conditions.[141] As to vertical integration, it is not disputed that network sharing does come with a significant cost to the operation of the incumbent firm, but it is also rather unlikely that this cost is enough to cancel out the aggregate benefits of increased competition and innovation for the entire market. Lastly, even given the nuisance of sharing, vertically integrated firms will probably always have an edge over independent innovators. As professors Farrell and Weiser explain, the firm serving as a platform provider

> has a stronger incentive than an independent firm to work harder on its applications: while innovators can seldom capture all their incremental value through simple pricing, the integrated provider . . . can capture some—perhaps all—of the residue in its platform sales. Second, even if a platform provider truly tries to cooperate with independent applications developers, it is unlikely

[135] Thomas W. Hazlett, *Rivalrous Telecommunications Networks With and Without Mandatory Sharing*, 58 FED. COMM. L.J. 477 (2005).

[136] *See* Jerry A. Hausman & J. Gregory Sidak, *Did Mandatory Unbundling Achieve Its Purpose? Empirical Evidence from Five Countries*, 1 J. COMP. L. & ECON. 173 (2005) (comparing the United States, the United Kingdom, New Zealand, Canada, and Germany; acknowledging that other important factors, such as competition from cable, the global ICT bubble burst in 2000, and wrong pricing may have had a bearing on investment incentives; and not finding a strong correlation between unbundling and lower incentives).

[137] *Id*. at 196, 202–03; Debra J. Aron & Robert W. Crandall, *Investment in Next Generation Networks and Wholesale Telecommunications Regulation* 38–39 (White Paper), *available at* http://www.lecg.com/files/upload/ingnwtr.pdf; Jerry Hausman, *The Effect of Sunk Costs in Telecommunications Regulation*, *in* THE NEW INVESTMENT THEORY OF REAL OPTIONS AND ITS IMPLICATION FOR TELECOMMUNICATIONS ECONOMICS 191, 191–93 (James Alleman and Eli Noam eds., 2007).

[138] *See infra* Part IV.B.

[139] Andrea Gavosto et al., *Investment in Next Generation Networks and the Role of Regulation: A Real Option Approach* 19–38 (ISEG-UTL Economics Working Paper No. 031/2007/DE, 2007).

[140] *Id*.; *see also* THE BERKMAN CENT. FOR INTERNET & SOC'Y AT HARVARD UNIVERSITY, *supra* note 3, at 83–112.

[141] Marvin B. Lieberman & David B. Montgomery, *First-Mover Advantages*, 9 STRATEGIC MGMT. J. 41, 42 (1988).

> to be as open with them as with its own applications division . . . . Third, if the integrated firm wants to hamstring applications rivals, it might be very easy to bias interface design, the timing of new releases, pricing policy, and other choices.[142]

It should be obvious by now that both scenarios (regulatory forbearance and sharing obligations) will result in some competition and innovation. However, because mandated sharing lowers the barriers to entry it will result in a greater number of competitors. While admittedly many of these competitors will never become important players and will fail to climb up the ladder of investment,[143] their contribution to the decentralization of the innovation process remains unabated. As an example take the case of Switzerland, where a high degree of penetration and reasonably low prices were achieved even though the market relied only on intermodal competition.[144] Despite these satisfactory numbers the Swiss market remained highly concentrated with the incumbent Swisscom still accounting for the majority of the broadband market, raising fears about an innovation bottleneck. This is why the national regulator eventually (in 2007) opted to adopt unbundling measures.[145] As will be shown in the next part, a combination of both regulatory intervention and forbearance is probably best in the position to deliver the desired results.

The discussion presented here is also relevant with regard to network sharing's twin concept, that of network openness, which, when mandated, obliges network owners to allow providers of complementary services to access their network. Network openness, however, can also be the result of competitive pressure (i.e., without regulatory intervention).[146] Keeping a network open means that network owners have to conform to a standard so that competitors are able to access their network. Standards present their own tradeoffs. On the one hand they increase modularity, thus allowing easier entry and greater upgradeability, and they facilitate scaling-up.[147] On the other hand, they are known to be prone to bias and subjectivity, which may lead to lock-ins and yield lower quality outcomes than that of a competitive process.[148]

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[142] Joseph Farrell & Philip J. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARV. J. L. TECH. 86, 102 (2003).

[143] *See* Hazlett, *supra* note 135, at 508.

[144] *See Next Generation Competition: Driving Innovation in Telecommunications*, BAIN & COMPANY, 28–29 (Oct. 2, 2009), http://www.bain.com/bainweb/PDFs/cms/Public/2009_10_02_LGI_REPORT.pdf.

[145] *See* Federal Office for Communications (OFCOM), The Swiss Telecommunications Market – An International Comparison (Extract from the 15th European Union Implementation Report Extended to Include Switzerland (annex 2), at 80 (characterizing the unbundling results as "quite encouraging").

[146] Because platform telecommunications networks exhibit modularity, third-party entrants only need to bear the cost of the layer upon which they want to do business. The lower cost of entry increases the potential players and accordingly, the utilization of the network and its commercialization value, making it more profitable to the owner. *See* ANNABELLE GAWER & MICHAEL A. CUSUMANO, PLATFORM LEADERSHIP: HOW INTEL, MICROSOFT, AND CISCO DRIVE INDUSTRY INNOVATION 1–14 (2002).

[147] Paul A. David & W. Edward Steinmueller, *Economics of Compatibility Standards and Competition in Telecommunication Networks*, 6 INFO. ECON. & POL'Y 217, 221 (1994).

[148] *See* SPULBER & YOO, *supra* note 95, at 169–71.

It is impossible to tell a priori whether openness is preferable. In some cases network openness has worked beautifully, while in others regulators felt that the cons outweighed the pros. An example of the first case is the Customer Premises Equipment (CPE, e.g., the telephone jack, RJ11) standardization, which led to the explosive growth of network equipment.[149] An example of the second case is the abandonment of the Computer Inquiries by virtue of the Brand X decision; purportedly, unlike the early days of the information services, by the early 2000s competition among network owners was adequately developed, lowering the risk of anticompetitive behavior to such an extent that the cost of regulation was unjustified.[150]

For the purposes of innovation what is important to emphasize here is that network sharing alone cannot create the conditions for a successful innovation system. Network sharing works well for maximizing access to the physical layer, but the physical layer is not the only layer players want to compete on. Entrants that simply want to offer a complementary service would rather pay network owners for rights to use their networks, rather than lease part of it or—even worse—deploy their own. If the network owners' facilities are open to service providers, either as a result of regulation or as a result of competitive pressure, the cost of entry drops significantly, as companies need only bear the cost of offering their service plus the cost of access to the network. In the alternative, if the underlying network remains closed, the few companies that control the underlying network architecture will also be able to control the innovative activity in the layers above it.[151] Hence, a case in favor of network openness can be made here.

B. Dynamic Sharing Equilibrium

Until this point in the Article, it was assumed that the relationship between innovation and network sharing is static, in other words, that fostering innovation requires a sharing regime to be constantly in place. This is far from true. The rationale behind sharing obligations[152] is to give small competitors "entry assistance" for as long as they need to climb up the "ladder of investment" and then let the market take over.[153] Otherwise, regulators risk overburdening incumbents while at the same time limiting small competitors' incentives to expand.[154]

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[149] *See supra* Part II.A.

[150] FCC, *supra* note 47, at 14873-76. While the underlying theory may be correct, the facts in this particular case do not seem to support it. Even despite the emergence of more platforms, including cable, DSL, wireless, and satellite, competition is still feeble, as even the Commission recently admitted in its 2010 National Broadband Plan. *See* FCC *supra* note 3, at 37.

[151] *See* Charles R. Morris & Charles H. Ferguson, *How Architecture Wins Technology Wars*, 1993 HARV. BUS. REV. 86, 88 (1993).

[152] Or for that matter any other measure regulators can adopt to facilitate entry; for example, the forty-three billion dollar public-private partnership the Australian government announced in 2009. *See* Joint Press Release, Minister for Broadband et al., New National Broadband Network (April 7, 2009), http://www.minister.dbcde.gov.au/media/media_releases/2009/022.

[153] Martin Cave, *Encouraging Infrastructure Investment via the Ladder of Investment*, 30 TELECOMM. POL'Y 223 (2006).

[154] Marc Bourreau, Pinar Dogan & Matthieu Manant, *A Critical Review of the "Ladder of Investment" Approach*, 34 TELECOMM. POL'Y 683, 685 (2010).

There are several ways to fine tune regulation to match the industry's needs at any given time.[155] Setting the right access price is probably the most obvious.[156] If the price is set too low, sharing is burdensome for incumbents but profitable for entrants, decreasing the incentives for the latter to build their own infrastructure. A price that is set to high may yield poor results in facilitating entry. However, high prices may be adopted at a later stage to mark the transition to a period where competitors need to start relying on their own assets exclusively. Another way to manage sharing is to change the network elements subject to the sharing obligations (e.g., switches and loops).[157] During the early stages of competition it makes sense to subject to sharing those elements that are the hardest to replicate, and gradually make fewer elements shareable.[158]

Whatever the micromanagement methods used while the sharing regime lasts, when the market becomes competitive enough regulators are expected to recede and abandon obligatory sharing.[159] This approach has been given different names, but it is mostly known as "temporary legislation" or "sunset provisions."[160] It is predicated on the superiority of competition as a regulator, calling authorities to gradually abstain from artificially trying to imitate competitive forces and instead loosen their grip on the system by making sharing obligations less onerous, or removing them altogether.[161] Depending on the conditions of the specific market, the scheme can be inverted, so that the network owner can initially enjoy exclusive use of its assets, with the sharing obligation coming later. This latter proposal makes more sense when the regulator wants to protect the incumbent's incentives to invest, for example in next-generation networks. In the end, once authorities no longer dominate the regulatory scheme, ex post antitrust measures can take over to safeguard fair competition among firms that are in the market as well as ensure fair entry prospects.[162]

This mandatory sharing scheme admittedly comes with many shortcomings. It requires constant monitoring, assumes that firms will eventually grow instead of forever

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[155] Johannes M. Bauer, *Regulation, Public Policy, and Investment in Communications Infrastructure*, 34 TELECOMM. POLICY 65, 68–69 (2010).

[156] Tommaso M. Valletti, *The Theory of Access Pricing and its Linkage with Investment Incentives*, 27 TELECOMM. POL'Y 659 (2003).

[157] Randolph J. May, *The FCC and Telecom Recovery: A Scorecard for Evaluating the New Unbundling Rules*, 2003 MICH. ST. DCL L. REV. 645, 655 (2003); Thomas M Jorde, J. Gregory Sidak & David J. Teece, *Innovation, Investment and Unbundling*, 17 YALE J. ON REG. 1, 29–30 (2000); *see also* Drexel, *supra* note 131, at 56–57.

[158] Martin Cave & Ingo Vogelsang, *How Access Pricing and Entry Interact*, 27 TELECOMM. POL'Y 717, 722–23 (2003); *see also* Elizabeth E. Bailey, *Innovation and Regulation*, 3 J. Pub. Econ. 285 (1974).

[159] *See Best Practice Guidelines on Innovative Infrastructure Sharing Strategies to Promote Affordable Access for All*, ITU 1–2 (2008), http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR08/PDF/GSRguidelines08_E.pdf.

[160] Jacob E. Gersen, *Temporary Legislation*, 74 U. CHI. L. REV. 274, *passim* (2007).

[161] *See, e.g.*, Alfred E. Kahn, *Telecommunications: The Transition from Regulation to Antitrust*, 5 J. ON TELECOMM. & HIGH TECH. L. 159, 161–62 (2006) (discussing a similar proposition by the Canadian ILEC TELUS, where the market share was set at five percent); Thomas J. Hall, *The FCC and the Telecom Act of 1996: Necessary Steps to Achieve Substantial Deregulation*, 11 HARV. J. L. & TECH. 797, 815–22 (1998).

[162] Marc Bourreau & Pinar Dogan, *Regulation and Innovation in the Telecommunications Industry*, 25 TELECOMM. POL'Y 167, 170–73 (2001).

relying on shared access, and is dependent on accurate information about the state of each firm in the market, which is not always easy or possible to acquire.[163] As a result, the record on the sharing experiment success is mixed.[164] However, the alternative of leaving the market at the mercy of giant firms does not fare well either. Indeed, the prime example is the U.S. market, which is locked in an everlasting duopoly, with relatively low speeds vis-à-vis prices, even despite the extensive investments in fiber, which still lies largely unused.[165] At least, a sharing regime with an expiration date can spark competition where there wouldn't be any or where it would remain severely limited, and then, once competition is established, leave the market unattended (save for antitrust regulations). The traditional observation made by economists is that we shouldn't be worried about concentrated markets if barriers to entry are low and capital markets are efficient.[166] But as briefly discussed previously,[167] it is rather doubtful that the telecommunications industry is characterized by low barriers to entry and low capital risk to make entry easy. And, again, the sharing regime endorsed here is not meant to be permanent; rather the only way to produce meaningful results (i.e., facilities-based competition) is for the regulator to step back once entrants have strengthened their position in the market.[168] At a very high level of abstraction the general tradeoff is a few years of managed competition and suppressed incentives for a properly working competitive market in the long run.

C. Innovation and Wireless Regulation

In principle, there is no reason why a more participatory system of diverse innovators cannot be sustained in wireless networks as well. Unlike wireline networks, however, physics imposes severe limitations on spectrum usage at any given time, and this has implications in terms of the desirability and effectiveness of the policy suggestions discussed so far: first, the accommodation of a multitude of players is not as easily feasible as in the wired market, and second, current technological constraints may call for more latitude for owners to manage their networks in a more restrictive way.

Because over-the-air radio waves travel mostly in every direction, it is likely that two transmitters in the same area will cause harmful interference to each other's signals,

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[163] *See* Bourreau, *supra* note 154, at 690–91.

[164] *See supra* notes 142–147 and accompanying text.

[165] *See* Rob Frieden, *Lies, Damn Lies and Statistics: Developing a Clearer Assessment of Market Penetration and Broadband Competition in the United States*, 14 VA. J.L. & TECH. 100 (2009) (interpreting available data to show that the U.S. broadband market is very concentrated and performs badly).

[166] *See* Richard A. Posner, *The Chicago School of Antitrust Analysis*, 127 U. PA. L. REV. 925, 944–48 (1979) (tracing the transition to the modern understanding of the relationship between concentrated industries and entry barriers).

[167] *See supra* Part II.

[168] Almost all economic models concur on the finding that continuous sharing options can stagnate the industry as they diminish the incentives for expansion. *See* Alessandro Avenali, Giorgio Matteucci & Pierfrancesco Reverberi, *Dynamic Access Pricing and Investment in Alternative Infrastructures*, 28 INT'L J. IND. ORG. 167 (2010); Marc Bourreau & Joeffrey Drouard, *Stepping Stone or Stonewall? Progressive Entry and the Incentives to Invest in Alternative Infrastructures* (Telecom ParisTech Working Paper No. ESS-10-07, July 2010).

making both signals illegible.[169] This attribute of wireless communications has served as the foundation for the licensing regime that still dominates the regulation of wireless communications.[170] Since the available spectrum is finite and can therefore accommodate only a certain number of transmitters, regulators established a regime of licensing, according to which only licensed actors can use a specified frequency band and usually for a predetermined use (e.g., TV broadcasting, cell phone communications, etc.).[171] However, recent technological advancements have relaxed (but not eliminated) the assumption that the spectrum is so tightly limited, bringing the scenario of an open commonly shared wireless band closer to reality.[172]

A commons-based system is predicated upon the free use of the spectrum by anyone without having to obtain a prior license, as long as simple rules are adopted on how to keep communications separate.[173] This is effectuated by technologies that rely on low-power signals and intelligent receivers, so that the main burden of keeping communications intelligible is placed on the receiver and not on the network.[174]

From the perspective of innovation, a commons-based system allows for the substitution of innovation from the few licensed operators by the decentralized innovation from anyone who abides by the connection standards of the network.[175] Besides the positive effect of a multiplicity of innovators, the commons-based system also fosters diversification of innovation, as the innovating actors are not tied to a specific revenue model or interest.[176] Also, because the barriers to entry are much lower, the cost of innovation accordingly drops. As a result, it is easier for entrants both to invest and to recoup the cost of their investments, thus allowing for faster innovation cycles and more flexibility.[177] By way of contrast, in a system where few actors make enormous

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[169] FCC Frequency Allocations and Radio Treaty Matters; General Rules and Regulations, 47 C.F.R. § 2.1 (2010).

[170] *See generally* Gerald R. Faulhaber & David J. Farber, *Spectrum Management: Property Rights, Markets and the Commons*, *in* RETHINKING RIGHTS AND REGULATIONS: INSTITUTIONAL RESPONSES TO NEW COMMUNICATIONS TECHNOLOGIES 193 (Lorrie Faith Cranor and Steven S. Wildman eds., 2003) (overview of wireless communications licensing regime).

[171] *See* Philip J. Weiser & Dale N. Hadfield, *Spectrum Policy Reform and the Next Frontier of Property Rights*, 15 GEO. MASON L. REV. 549, 558–60 (2008) (reviewing the legacy system of regulation).

[172] Kevin Werbach, *Supercommons: Toward a Unified Theory of Wireless Communication*, 82 TEX. L. REV. 863, 882–903 (2004) (stating that "[t]here is no proper way to explain what spectrum is, because there is no such thing as spectrum").

[173] Johannes M. Bauer, *A Comparative Analysis of Spectrum Management Regimes* 7–9 (2002) (unpublished manuscript), http://intel.si.umich.edu/tprc/papers/2002/85/SpectrumManagement.pdf.

[174] *See* Yochai Benkler, *Some Economics of Wireless Communications*, 16 HARV. J. L. & TECH. 25, 41 (This technology "was not practically usable for wireless communications until substantial computation became cheap enough to locate in receivers and transmitters, but it is now the basis of most advanced mobile phone standards, as well as the basic 802.11 standards and other wireless systems."); *see also* NUECHTERLEIN & WEISER, *supra* note 42, at 251–57.

[175] *See* Kevin Werbach, *Higher Standards Regulation in the Network Age*, 23 HARV. J. L. & TECH. 179, 187 (2009).

[176] *See* Benkler, *supra* note 174, at 72.

[177] J. H. Snider, *Reclaiming the Vast Wasteland: The Economic Case for Re-allocating the Unused Spectrum (White Space) Between TV Channels 2 and 51 to Unlicensed Service* 12 (New America Found. Wireless Future Program, Working Paper No. 13, 2006).

infrastructure investments in the network (including the cost of obtaining a license to operate in certain frequencies), the regulatory policy should be realigned to give them enough time to recapture the value of the investment. This not only delays development, but may also prove harmful from the social welfare point of view if the market gets locked in an inefficient initial investment.[178]

Spectrum commons is an exciting idea, but technological and economic limitations suggest that for now, and at least for the foreseeable future, it will have to coexist with the non-free spectrum.[179] The distribution within the two extremes—freely shared spectrum and non-free spectrum—can take several forms, and the choices ultimately depend on further technological developments.[180] Since the non-free spectrum regime will exist for many years to come, regulators should at least try to maximize the value of the non-free frequencies. The currently prevailing system—which only provides for a right to use (i.e., a license), not a right to own a band—has been severely criticized as leading to underutilization, and instead a property rights regime has long been counter-suggested.[181] Property rights increase the incentives to deploy assets, as they maximize the assets' value by conferring the certainty of ownership and the option to lease or sell.[182] Proponents of property rights believe that a property system will positively affect investment and innovation, as it will create a marketplace for these rights, a quality that the commons-based system lacks since participation is free.[183]

Even if the vision of spectrum commons is not realized, a legitimate claim can be made at least that non-free frequencies (licensed or owned) remain open with regard to the end-user equipment and to the applications that run on them. An intellectual movement calling for wireless openness has been dubbed "wireless *Carterfone*," as it resembles the context in which the *Carterfone* case arose.[184] Wireless *Carterfone* comes as a response to the licensees' incentives to restrict some uses of their frequencies to protect their investment.[185] There is an innovation cost to that: the licensee controls the

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[178] *See* Eli M. Noam, *Spectrum Auctions: Yesterday's Heresy, Today's Orthodoxy, Tomorrow's Anachronism. Taking the Next Step to Open Spectrum Access*, 41 J. OF L. & ECON. 765, 776–77 (1998).

[179] This model is often referred to as hybrid wireless; it integrated multiple wireless networks and multiple spectrum access models. *See* William H. Lehr & John M. Chapin, *Hybrid Wireless Broadband*, 37th Research Conference on Communication, Information and Internet Policy, 2009) *available at* http://people.csail.mit.edu/wlehr/Lehr-Papers_files/LehrchapinTPRC_2009.pdf.

[180] Ellen P. Goodman, *Spectrum Rights in the Telecosm to Come*, 41 SAN DIEGO L. REV. 269, 380–84 (2004).

[181] See generally the classic work by Ronald Coase, *The Federal Communications Commission*, 2 J. OF L. & ECON. 1 (1959).

[182] Faulhaber & Farber, *supra* note 170, at 198–204.

[183] *See* Thomas W. Hazlett, *Tragedy T.V.: Rights Fragmentation and the Junk Band Problem*, 53 Ariz. L. Rev. 83 (2011).

[184] *See supra* Part II.A.

[185] *See, e.g.*, the restrictions on Sprint's data plan:

> Examples of prohibited data uses: Sprint data services are provided solely for purposes of web surfing, sending and receiving email, photographs and other similar messaging activities, and the non-continuous streaming of videos, downloading of files or on line gaming. Our data services may not be used: (i) to generate excessive amounts of Internet traffic through the continuous,

equipment and applications that can run on its network and therefore only the kind of innovation that is compatible with the licensee's interests will likely survive.[186] The effect of an application of a *Carterfone*-like obligation to wireless network operators would be to "liberate device innovation in the wireless world, stimulate the development of new applications, and free equipment designers."[187] Some companies have already started opening up their network,[188] and the Commission has taken steps towards freeing spectrum with open access obligations,[189] but we are far from a uniform practice as broad as *Carterfone*.[190]

Before we embrace wireless *Carterfone*, though, we need to acknowledge that wireless networks are different in some respects that make them justifiably less open and flexible. First, bandwidth in wireless networks is more limited.[191] The inherent unreliability of wireless transmission makes it error-prone, which in turn limits the actual carrying capacity of a wireless channel, even if its nominal bandwidth capacity is the same as that of a wireline channel. Second, wireless communications suffer from much lower fidelity, because the carrying medium—electromagnetic waves propagating through open air—is more susceptible to interference, noise, attenuation, multipath fading, etc.[192] Third, wireless traffic is more unpredictable due to mobility and congestion peculiarities, making wireless management more difficult and integration between the network and the device more necessary.[193] Lastly, wireless devices lack the sophistication and capabilities of wireline end nodes, which means that some of the intelligence has to migrate to the core of the network, leaving less space for innovation at the ends.[194]

> unattended streaming, downloading or uploading of videos or other files or to operate hosting services including, but not limited to, web or gaming hosting; (ii) to maintain continuous active network connections to the Internet such as through a web camera or machine-to-machine connections that do not involve active participation by a person . . . .

Terms & Conditions, SPRINT.COM, http://shop.sprint.com/en/legal/legal_terms_privacy_popup.shtml (last visited May 25, 2011).

[186] Eli M. Noam, *The Next Frontier for Openness: Wireless Communications* 9–19 (Paper for the 2001 Telecommunications Policy Research Conference, Alexandria, Virginia, 2001).

[187] Wu, *supra* note 19, at 391.

[188] *See, e.g.*, Verizon's Open Development and 700 MHz C-Block LTE plans, https://www22.verizon.com/opendev/index.aspx (last visited May 25, 2011).

[189] *See* Charles M. Davidson & Michael J. Santorelli, *Seizing the Mobile Moment: Spectrum Allocation Policy for the Wireless Broadband Century* 29–32 (New York Law School Legal Studies Research Paper No. 09/10 #32, 2010).

[190] *Cf.* Petition of Skype Communications S.A.R.L. to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks, RM-11361 (2007) (requesting a *Carterfone*-like regime for wireless networks too).

[191] Christopher S. Yoo, *The Changing Patterns of Internet Usage*, 63 FED. COMM. L.J. 67, 77 (2010).

[192] *Id*. at 78.

[193] Faulhaber & Farber, *supra* note 52, at 328–29.

[194] As technology advances these limitations will gradually fade away. For example, the dramatic drop in the cost of computation has enabled devices to become less monolithic. The so-called "software-based radios" are equipped with generic hardware whose functions are controlled by whatever software runs upon it. This allows greater flexibility and upgradeability, while—most importantly—"facilitat[ing] unbundling of the service provider portion of the wireless value chain." William Lehr et al., *Software Radio:*

Moreover, wireless operators reasonably fear a loss in revenues if they open up their networks. There is no better illustration of the threat they face than Apple's excuse for rejecting the Google Voice application on the iPhone: "The application has not been approved because, as submitted for review, it appears to alter the iPhone's distinctive user experience by replacing the iPhone's core mobile telephone functionality and Apple user interface with its own user interface for telephone calls, text messaging and voicemail."[195] The pricing model of wireless communications has been developed with voice charged by the minute in mind. It is unfair to expect wireless operators to switch to a completely open system that could potentially cannibalize their core business and at the same time offer this service at the same price and quality as they now do.

The above observations suggest that transformation in wireless openness may justifiably proceed at a slower pace compared to wireline networks. That said, the escalating trend toward convergence between wireline and wireless networks will show in the near future whether the greater openness of wired networks is appropriate and efficient for wireless networks as well.

V. CONCLUSION

Innovation has been an important factor throughout the history of telecommunications liberalization, and past pro-innovation regulatory steps have proven particularly successful. Innovation can be distinguished from competition, although the two concepts are closely related, and several reasons have been presented on why the fast-changing, networked, and technical nature of telecommunications offers a very favorable environment for innovation to thrive, and why innovation benefits from a large number of actors. Moreover, even small players are useful in the innovation process, and a decentralized polyarchic system of innovation can work, without that meaning that it is superior to centralized innovation. The two systems can and do coexist.

With that in mind, the goal of a diverse and populous innovation pool is reconcilable with both the high barriers to entry in telecommunications and the disincentives that sharing obligations may create. The key is to construct a system of regulation whereby entry is facilitated only while competition remains underdeveloped. Despite its many shortcomings, this scheme of managed competition promises to set the conditions for a viable competitive arena in the long run.

Implications for Wireless Services, Industry Structure, and Public Policy, 49 COMM. & STRATEGIES 15, 33 (2003).

[195] *Apple Answers the FCC Questions*, APPLE.COM, http://www.apple.com/hotnews/apple-answers-fcc-questions/ (last visited May 25, 2011).