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WALLED GARDEN RIVALRY: THE CREATION OF MOBILE NETWORK ECOSYSTEMS

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Walled Garden Rivalry

The Creation of Mobile Network Ecosystems

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Dynamic competitive forces are dramatically altering mobile markets in the U.S. and around the world. Wireless networks, having sunk considerable capital in the creation of phone systems, must not only compete among themselves for subscribers, but also need to form strategic alliances with emerging handset application platforms (HAPs) created by such firms as Research in Motion (Blackberry), Apple (iPhone), and Google (Android). Current developments illustrate two fundamental aspects of innovation. First, that innovations created by one set of investors may generate returns for complementary suppliers, either via coordinated activity (strategic platforms) or competitive rivalry (appropriation). Second, that the efficiency of such ecosystems may be enhanced by market structure innovations that either extend vertical control or delimit it. This runs counter to the prevailing popular and regulatory sentiment that "open" platforms offer categorically superior welfare outcomes than do "closed" systems – aka "walled gardens."

Key Words: dynamic competition, mobile markets, walled gardens, industrial structure, business models, vertical integration.

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I. I. Introduction

In recent years many high-technology markets have witnessed sharp swings in the level of vertical integration. In particular, mobile wireless networks are undergoing dramatic structural transformation. This is seen in the development of Handset Application Platforms - "wireless ecosystems" – accommodating a constellation of complementary devices, software and content supplied outside the network carrier space.

These platform developments continue to rely on actions of a vertically integrated network operator. Technologies, system architectures, and business models adopted by the carrier set the stage for development of ecosystems. Such iconic innovations as the Apple iPhone, and iPad and the vertically tied Apple Apps Store, have resulted. Rivalry throughout the industry (among networks, mobile operating systems, device makers, and mobile application developers) appears robust.

Some regulators, however, have determined that "open" platforms, where consumers select product bundles unimpeded by vertical restraints, are categorically superior to "closed" alternatives, often dismissed as "walled gardens." Of course, the flowers that bloomed in safe enclosures can be boosted by the protections afforded; lush hot houses are enabled where gains from productive gardening investments are internalized. Moreover, competition between "walled gardens" and "unfenced gardens" can be vigorous.

There is an extensive literature on the social benefits and costs of 'open' versus 'closed' systems. We do not attempt to summarize that literature here, although in section II we do discuss business ecosystems and their properties which display varying degrees of 'openess'. We suggest the reader peruse Mehra (2011), Zittrain (2008), Schwarz & Takhateyev (2010), Lerner & Shankerman (2011), and Barnett (2011). Barnett's general analysis is closest to that developed here for evolving mobile markets. He argues cogently that 'openess' and 'closedness' are matters of degree, that many 'open' systems are funded by corporations, and that many 'closed' systems exhibit altruistic elements. Barnett suggest that both types of models attempt to solve a 'platform's dilemma.' That is the challenge faced by an innovative host who must achieve scale, producing salubrious network effects for its platform, by enticing users and producers of complements, while ensuring such cooperative agents that their surplus will not be appropriated (say, by price increases) if the platform champion emerges victorious..

The interesting dynamics associated with this strategic platform game is demonstrated in today's wireless ecosystems. , We see the "strong vertical" (walled garden) systems deployed by pioneering mobile carriers in Japan like DoCoMo, the emergence of RIM Blackberry, Google Android, and Apple iPhone device and applications platforms – each exhibiting varying degrees of 'openness' – via contracts with carriers, hardware suppliers, and independent software developers.

Our focus, however, is on the macro market forces at work rather than the incentive compatible issues that dominate much of the literature (including Barnett [2011]).

In this fast paced world of systems innovation, it is clear that no firm is safe. Nokia, once the most trusted and feared brand in wireless devices, has seen its mobile operating software[5] – Symbian – market share collapse, with global sales falling from nearly 60% of smartphone units to under 20% between 2007 and 2010, by which time the firm was posting huge operating losses. The proximate cause of this reversal of fortune was the entry of two mobile competitors, Apple (in software and devices) and Google (in software). By 2011, Nokia was forced to abandon its recently dominant platform, forming a new alliance with Microsoft and shifting its default operating system to Windows 7. In what follows, we explore the economics of integration in wireless networks, and critique the proposition that lower walls inherently make for better gardens.

It is our thesis that policy makers, legal specialists and antitrust economists have failed to properly understand such systems development processes. The phenomenon at hand involves not only technological innovation; it also involves the creation and co-creation of markets. Such contributions are important to the development of the economy and to competition. Yet there is little analytical apparatus in economics in the subfield of industrial organization/antitrust economics that attaches significance to this phenomenon. Accordingly, the probability is low that the regulatory agencies – in the case of telecoms, the FCC, the FTC, and the DoJ – will make good decisions. Indeed, there is a penchant to take the market creation and co-creation functions for granted and then intervene if the innovator is "too successful."

This proclivity comes from the commonly employed assumption that markets always exist. As a consequence, it is felt that market creation functions are not something public policy needs to worry about. While some economists have recognized that competition for the market is as important as competition within it, there is little recognition of the importance of competition to create the market and to develop dynamic ecosystems.

This paper, in Sections II, outlines a view of market competition that incorporates the academic literature on innovation and ecosystems (see, e.g., Teece 1986, 2006, 2007). Here, platform creation and product innovation go hand in hand. The innovator launches an enterprise with sizeable irreversible capital outlays that create real options in future periods. Capturing a sufficiently large fraction of the ultimately valuable options to justify the initial investment is the challenge. The task is complicated not only by the presence of rival networks, but by uncertainty

[5] Mobile operating systems run cellphones (including smartphones and tablets, the more sophisticated mobile devices designed to run on broadband networks), providing the user interface. They also host software applications that can be downloaded to the device. Hence, emerging applications platforms in mobile markets are characteristically defined by the OS.

related to the distribution of returns across the ecosystem it creates. The innovator must gain a sufficient revenue split from its partners producing complements, and maintain the platform's competitive superiority against rival innovators (supported by networks and platforms of their own).

In Section III, we then turn to a description of how these vertical/horizontal strategies are playing out in U.S. mobile markets. Vertical structure is evolving, both growing stronger and weaker in alternative dimensions, finding new efficiencies through coordinating innovations in the core (network) and at the edge (applications and content). This leads to the conclusion that regulatory mandates to impose a rigid structure on the market, as the Federal Communications Commission did in the 2008 700 MHz C license requirement forcing "open access" (FCC 2007), are likely to be counter-productive.

These developments and policy conclusions are, in Section IV, buttressed by examining the evolution of Japanese and European mobile markets. NTT DoCoMo, the leading Japanese carrier unveiled an innovative platform long before the iPhone: iMode. By exercising tight controls over how third party applications could program, price, and market their services to network subscribers, DoCoMo created a classic "walled garden." European carriers, meanwhile, were far less aggressive in their vertical investments, leaving far more to the discretion of software developers and other independent firms.

Some European and US wireless carriers did build their own walled gardens but without the business strategies that drove DoCoMo, its two Japanese rivals, and South Korean wireless firms. The "closed" Japanese models proved far more accommodating for third party apps; both networks and wireless web usage exploded under the "strong vertical" coordination provided by the mobile operator. This seeming paradox is explained by the efficiencies afforded via vertical integration, and the competitive dynamics of walled garden rivalry. It also shows that simply erecting walls -- as some US firms attempted with an alternative to iMode -WAP -- does not guarantee a garden. Outside of Japan, Korea, and Norway, WAP was largely unsuccessful.

A short summary and conclusion follows in Section V.

II. II. Integration, Innovation, and the Creation of Markets and Ecosystems

II.a. General

All firms vertically integrate to some degree and, at the same time, rely on inputs obtained through "the price system."[6] Much attention is paid by managers, investors, and academic theorists to discovering the optimal mix.[7] Integration brings more resources within the firm's direct control, generally complicating the management function. But it can reduce opportunism,[8] improve information sharing (reducing transaction costs),[9] eliminate double marginalization,[10] assist product "flow,"[11] and decrease systematic risk.[12] It can facilitate both the creation of value and the capturing of value.

Consider first the creation of value. Integration is particularly important when new products and processes with a systematic dimension are implicated. One obvious case of this is the n-sided market phenomenon, where the success of a product requires the development of complements.

However, even before the n-sided market phenomenon was explicitly recognized, the innovation literature distinguished between innovations which are systemic and those which are autonomous. The latter can occur in any environment; the former requires deep coordination. Pitelis and Teece[13] have used the term "co-creation" to recognize the entrepreneurial component that is required. Put differently, when markets don't exist (in the sense that the consumers are not ready, willing and able to purchase an available product) then entrepreneurs /managers often need to create them. This is sharply at odds with standard economic theory which typically assumes that markets exist for everything at all times. This assumption -- market existence -- is often not the case with pioneering innovations. A striking example is the Apple iPod. Without the iTunes music store, it is doubtful that the iPod – arguably otherwise just a nifty MP-3 player – would have succeeded on anything approaching the scale it achieved.

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6 The classic formulation of the scope of the firm is found in R. H. Coase, *The Nature of the Firm*, 4 ECONOMICA (Nov. 1937).

7 Paul Joskow, *Vertical Integration*, in the HANDBOOK OF THE NEW INSTITUTIONAL ECONOMICS (Springer/Kluwer; 2005).

8 Benjamin Klein, Robet G. Crawford & Armen A. Alchian, *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 JOURNAL OF LAW & ECONOMICS 297 (Oct. 1978).

9 Oliver Williamson, *The Vertical Integration of Production: Market Failure Considerations,* 61 AMERICAN ECONOMIC REVIEW 112 (May 1971).

10 Jean Tirole, THE THEORY OF INDUSTRIAL ORGANIZATION (Cambridge, MA: MIT Press ; 1988), Ch. 4.

11 Alfred Chandler, STRATEGY AND STRUCTURE (Cambridge, MA: MIT Press; 1993).

12 Constance Helfat & David J. Teece, *Vertical Integration and Risk Reduction*, 3 JOURNAL OF LAW, ECONOMICS AND ORGANIZATION 320 (Spring 1987).

13 Christos N. Pitelis & David J. Teece, *Cross-Border Market Co-creation, Dynamic Capabilities and the Entrepreneurial Theory of the Multinational Enterprise*, 19 INDUSTRIAL AND CORPORATE CHANGE 1247 (Aug. 2010).

Market co-creation using proprietary interfaces may also allow an innovator to capture a larger proportion of the value it creates. When firms expect to capture higher profit they will be more intensely incentivized to invest in creative endeavors.[14] Yet these dynamics -- remunerating risk takers and thereby sparking future economic growth -- may appear to conflict with other forms of economic rivalry. Once an innovation platform – say, a wireless telephone network – has been established with a large, vertically-integrated effort, it enables other profit opportunities. When carriers and others design these complementary sub-markets with proprietary interfaces, regulators may view the structure created as anti-competitive, especially if the effort becomes highly profitable.

Yet, a burgeoning literature on technological innovation suggests that appropriability is a major challenge: that investors creating new platforms will generate supra-competitive returns for various other firms but sub-competitive payoffs for their own.[15] This lack of appropriability not only limits the innovation in question, thwarting its growth, but produces market signals that may deter a wide range of socially useful entrepreneurship. This social tradeoff between appropriability and market power is familiar. Our contention here is that the value created in forming markets, as well as the transient nature of market power, need be carefully considered in making welfare judgments about innovation.

II.b Business Ecosystems

In the past, the boundaries of industries and markets (and possibly submarkets) have set the context within which competition is evaluated, both from a strategy and policy perspective. Indeed, some business schools teach courses that endeavor to analyze competition by studying market structure and entry barriers -- an industry-level concept.

We suggest that, outside a static context, narrowly-defined industries are not _particularly useful as the unit of analysis. This is because the competition that matters often comes from outside of the industry. Moreover, much that is of competitive significance takes place at a more granular level inside the industry. We find the concept of the ecosystem to be more useful. It also helps point attention to a key question: how does a market start?

Where common standards are critical to performance and common interfaces are employed so that certain product architects are shared, "platforms" can be said to

[14] Alternatively, the expectation that returns will be largely appropriated by other firms will reduce dynamic efficiency. "[M]arkets don't work well… [when] the profits from innovation may accrue to the owners of certain complementary assets, rather than to the developers…" David J. Teece, *Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy*, 15 RESEARCH POLICY 285 (Dec. 1986), p. 285.

[15] David J. Teece, *Reflections on "Profiting from Innovation,"* 35 RESEARCH POLICY 1131 (Dec. 2006).

exist (Meyer & Utterback, 1993; Robertson & Ulrich, 1998). Platforms are usually proprietary, in that standards are patented. Platforms typically result in specialization (niche or focused strategies are viable for entrants and smaller firms), resulting in shorter development times and easier commercialization for the providers of complementary products and services. Competitive superiority is sought by a platform innovator, bolstered by cooperation with the providers of complements (Gawer & Cusumano, 2002), jockeying for position against rival ecosystems.

Definitionally, a business ecosystem is a number of firms -- competitors and complementors -- that work together to create a new market and produce goods and services of value to customers. Especially in digital industries, an ecosystem can contain a platform.

Over time, occupants of an ecosystem co-evolve. Competitors need to respond to competition from within and beyond the ecosystem, while also co-evolving and shaping their shared ecosystem to their own advantage and to the advantage of customers. A company's (evolutionary) fitness depends on how well it is suited to the ecosystem it occupies and how well it is able to stimulate and support innovation, satisfying customer needs.

Of course, the biological analogy is not perfect. In business systems economic agents (managers, entrepreneurs, investors) make conscious decisions. With biological systems there is no conscious intent. In business ecosystems, appropriately "fit" firms survive and prosper. Perfect adaptation rarely, if ever, occurs. Variation (new organizations, innovation, new knowledge), selection, and development are present in an ecosystem.

Within an ecosystem, the health and vitality of each firm is dependent on the health and vitality of all firms in the ecosystem, although some more than others. The shopping mall, and the bumble bee hive, are classic examples. The viability of an ecosystem depends, when network externalities exist, on critical mass, productivity, innovation, learning and cooperation. An ecosystem "manager" or "host" is also a critical success factor, especially in digital markets that require compatibility standards (coordination) and complementary services to achieve full functionality. Ecosystems allow, and benefit from, specialized niche players.

Business ecosystems are not islands unto themselves. They produce products and services in competition with rival ecosystems. Whereas Charles Darwin researched (biological) ecosystems that were isolated from each other, this is not the case with business ecosystems embedded in open economies. To the contrary, business ecosystems often compete head to head, may the most efficient ecosystem win.

Whereas natural (biological) ecosystems are self-organizing, business ecosystems need not be, and frequently benefit from, an ecosystem "manager/captain." This "host" often provides coordinating mechanisms, rules, key products, intellectual property and financial capital to create structure and momentum for the market it seeks to create.

Ecosystem members cooperate; ecosystems compete.[16] . In this sense, cooperation is the handmaiden of competition. This has been recognized historically, as vertical relationships (integration) are seen to support horizontal competition. Business strategies within an ecosystem need to be coordinated, collectively, not competitively. Such coordination improves and intensifies horizontal rivalry.

A coordinated ecosystem strategy requires rules for admission/entry into the ecosystem. Absent such rules, delicate complementarities can be disturbed and opportunities forsaken. With complexity, there are simply too many inter-discrepancies to allow a completely self-organizing approach. Put differently, ecosystems are rife with externalities. However, individual companies should be free to not enter particular ecosystems. Tie-ins are OK. Tie-outs are not. From a public policy position, ecosystem-to-ecosystem rivalry (each featuring intra-ecosystem cooperation) should be recognized as natural and beneficial.

As explained below, the mobile telephony industry provides many examples of how business ecosystems perform and how they compete. Ecosystems in mobile telephony are occupied by four main clusters of participants: network operators, handset manufacturers, platform vendors, and content providers. What is most interesting is the emergence of very different models of platform captains. In some countries (like Japan) service operators such as NTT Docomo and KDDI are the ecosystem/platform captains. In the USA, handset manufacturers (e.g., Apple) and content providers (e.g., Google) have recently emerged as ecosystem/platform captains.

In Japan, the ecosystem/platform providers decide which handset to procure and which platforms are adapted. The performance of the networks depends on the handsets adopted and vice versa. This is particularly true in the early stages of development of a market. In the USA, the center of gravity has recently shifted to handset platforms; hosts of such platforms are now able to bring value to the carriers – and charge mobile operators for the benefit. When Apple recently agreed to make the iPhone 4 available for subscribers on the Sprint network, the contract committed Sprint to buy 30 billion iPhones over four years at an astonishing price of about $20 billion. Total enterprise value of Sprint is only about $25 billion.[17] This competition in models of eco -systems and very different 'captains' indicates the dynamic competition at work.

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[16] David J. Teece, *Competition, Cooperation, and Innovation: Organizational Arrangements for Regimes of Rapid Technological Progress*, 18 JOURNAL OF ECONOMIC BEHAVIOR AND ORGANIZATION 1 (June 1992).

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II.c Closed Business Ecosystems

Apple's iPod, iPhone, and iPad are examples of closed business ecosystems. Participating in the ecosystem requires recognizing Apple's IP and abiding by Apple's rules (e.g. access to the Apple App Store requires application developers to grant Apple editorial control, including the right to disapprove of content[18]). The rules are designed both to secure a superior customer experience and to protect Apple's business model. It has (thus far) worked. Apple's success in wireless products indicates that a managed ecosystem can be superior to "unplanned" alternatives, yielding economic returns for the innovator.

This is not surprising. When (co-) specialized investments are required to produce a desirable customer solution; there is nothing in economic theory to suggest that such investments will be perfectly coordinated by market processes (Richardson, 1972). The trade-off is that no one can (directly) improve on the iPod, iPhone, and iPad without Apple granting permission. Yahoo music subscriptions won't work on an iPod. The Verizon network wouldn't work with the iPhone until Apple decided it should and made sure that it would.

On the other hand, Apple is virtually maniacal in efforts to employ technologies produced externally, capturing global efficiencies (Linden). An iPhone, e.g., contains flash memory from Samsung (S. Korea); a baseband from Infineon (Taiwan); a gyroscope from ST Microelectronics (Italy); power management from Dialog Semiconductor (Taiwan); audio from Texas Instruments (USA); touchscreen control from Cirrus Logic (USA); and an e-Compass from AKM Semiconductor (Japan) – among many other inputs from suppliers around the world.[19] In this case, Apple is pursuing an "open innovation" development program (Chesborough) on a "walled garden" platform.

The success of Apple's walled garden runs contrary to some other episodes of industrial history. The Springfield Armory prospered after Blanchard's invention of a lathe that enabled even the unskilled operator to create identical rifle stocks. Standard parts from Blanchard's lathe overtook other forms of manufacture because they were inexpensive. The U.S. Army liked their interchangeability (Chandler 1977).

Apple's approach has enabled company co-founder the late Steve Jobs' penchant for a superior customer experience to be realized. It has been a gutsy bet for Apple; but it is paying-off for Apple, for Apple's customers, and Apple's complements. Economists should not be surprised: a faith in categorical "openness" and complete

[18] Similar to DoCoMo's i-mode, the 'father' eco-system captain.

[19] Jay Yarow, *Chart of the Day: What's Inside The iPhone, And How Much It Costs*, BUSINESS INSIDER (Aug. 12, 2011); http://www.businessinsider.com/chart-of-the-day-iphone-4-cost-breakdown-2011-8.

fragmentation can only be sustained by dogma. So long as inter-ecosystem competition is preserved; economic welfare should be enhanced.

Yet Apple's platform structure is one of many, and alternatives are also proving themselves competitive. The emergence of Google's Android – a mobile handset platform riding on a mobile operating system software package owned and licensed by Google – is a direct counter strategy to Apple's mobile ecosystem. Android offers far less vertical control of applications or handsets. It relies on independent complement producers, even in hardware (devices), and gives them wider latitude to innovate. Android-based devices have proven extremely popular in the smartphone market, and – with amazing speed – have become the largest sellers, globally, in early 2011. As recently as 2007, Nokia's Symbian mobile OS enjoyed nearly 70% market share. (See discussion below.)

What is best: a walled garden or an open field? There is no one answer. We argue that the walled garden approach is often superior if the ecosystem/platform "manager"/"captain" promotes innovation and entry and manages quality in the ecosystem.(see the discussion of i-Mode below) The iPhone is an iconic innovation, as is the iPad that followed. Their vertical links to media content (iTunes) and software applications (App Store) add restrictions to device use, but also generate considerable consumer value. In such cases, where the ecosystem captain promotes yet "manages" innovation to improve the customer experience, virtual isn't virtuous (Chesbrough & Teece, 1996). Put differently, "open" is not categorically superior to "closed," a caricature of the market advanced by both academics (Wu 2007) and regulators (FCC 2010). As Chesbrough & Teece (2002) explained, systemic innovation (as compared to autonomous innovation) requires an integrated (closed; walled garden) approach. Moreover, a great deal of innovation is systemic.

Relatedly, when new businesses require "co-creation" (Pitelis & Teece, 2010) involving multiple businesses, it may also require support from public institutions and standard setting bodies.[20] In such cases, traditional competition analysis at the level of the industry is not particularly helpful. In static environments, or in circumstances where tight technical compatibility isn't needed, the ecosystem idea (whether open or closed) may not be pertinent. However, when new markets and industries are being created and compatibility and complementarities matters, the ecosystem concept is highly relevant to the understanding and management of business and policy.

When a production system is stable, coordinated development may not be essential. When changing, it is critical to pace coordinated complementary (or co-development) activities.

[20] We show below that a wide industry standard setting body for WAP was not successful – having buy-in from many firms is not a necessary or sufficient condition for success.

Consumers don't buy open or closed; they buy the best solutions (products and services). Hence, success depends upon the system that manages well "behind" the curtain. The user experience is, in the end, what counts. So far, it seems that at least in mobile telephony, the walled garden approach is winning.

However, history also shows that firms can fall behind in innovation in one or more parts of a closed ecosystem. This causes what Hughes (1983, 1986) calls "reverse salients" to emerge. Arguably Microsoft fell victim to this. Microsoft did not properly nurture its ecosystem. It often saw complementors as competitors. If they became too big a concern, they would get bought out, under threat of a tough road ahead if they didn't acquiesce. This discouraged developers; they went to other platforms. This slowed evolution and learning and innovation in Microsoft's (Windows) ecosystem. Microsoft "consumed" its own developer ecosystem. Buy outs of complementors on the one hand encouraged entry (to achieve a exit via acquisition) but snuffed out developers "paths of learning" (Chandler). In the long run, this has proved costly to Microsoft. It didn't have to be that way. Walls themselves do not guarantee success.

III. Further Application to Mobile Telephony

These dynamics of the market process are brightly illustrated in the wireless sector today. There is a pronounced structural shift underway in 3G (third generation) mobile networks, phone systems that deliver broadband connectivity to handsets, tablets and notebook computers. Carriers have sunk hundreds of billions of dollars to create four (or more) national mobile networks in the U.S.,[21] giving rise to a "wireless ecosystem."

A pronounced feature of that environment is the emergence of sub-systems –what we have labeled as *handset application platforms* (HAPs). Research in Motion (RIM) offers Blackberry devices, Apple the iPhone and iPad, Palm (now Hewlett Packard) the Pre, Nokia a broad product range running Symbian and Windows 7 (in alliance with Microsoft) operating systems, and Google, with a host of manufacturers, an array of devices embedding Google's "open" operating system, Android. RIM, Apple, Nokia and HP all support platforms which vary in the height and width of their 'walls.' Each of their devices also embeds a multi-pronged vertical structure. Principally, HAP developers (a) negotiate terms on which buyers of their phones (subscribers) gain access to given mobile networks, effectively splitting subscriber fees, advertising revenues, and marketing investments with carriers; (b) establish a

[21] In March 2009, some 273.8 million subscribers were recorded for the industry. By carrier (in millions): Verizon Wireless, 86.6; AT&T, 78.2; Sprint, 35.4; T-Mobile, 33.2; MetroPCS, 6.1; Leap, 4.3; others, 30.0 (Merrill Lynch 2009, p. 187). Hence, in addition to the top four national networks, smaller players exist and, through roaming agreements, offer national coverage on comparable terms. In addition, resellers like TracFone compete for retail services, while leasing wholesale capacity from one or more networks, and Clearwire is building out a nationwide 4G (fourth generation) wireless network featuring data speeds far in excess of 3G.

mechanism for selling software applications and digital content to handset owners. When successful, the ecosystem "curtains" promote innovation, generating competitive superiority vs. rival structures.

Certain aspects of this business model are remarkable. First, the equipment vendors are effectively purchasing spectrum inputs to enable customers' use of their handsets. While regulators in the U.S., E.U., and elsewhere, have long pursued the construction of "secondary markets" in spectrum, they have missed the evolution of just such an institution. It is not just the network that, selling services to subscribers, captures spectrum values; producers of complements, including handsets and applications that ride on handsets, transact with carriers to "deploy bandwidth," as well. A demonstrated efficiency is that spectrum rights (mobile licenses) are held by the same enterprises that own wireless networks. This ownership integration of highly complementary assets suggests that economic coordination is improved, opportunism mitigated. In this context, the "naked spectrum" spot markets pursued as a policy goal by many regulators and analysts (Noam 1998) appear to fail the market test.

Second, the HAP developer establishes a mechanism enabling its customers to obtain added functionality. Specifically, it creates something like Apple's App Store, where iPhone users download applications for their phones (or iPods or iPads). Prior to the June 2007 launch of iPhone, the carrier typically maintained control over the flow of such transactions. This vertical structure arose in the period when data was first sent over mobile networks. While DoCoMo's i-mode service (eerily similar to Apple's App Store, but organized and maintained by the mobile network operator), many carriers using second generation WAP (Wireless Access Protocol) erected high-walls around available content and applications. Not much grew in these gardens.[22] Ringtones, typically available only through the carriers, were one of the few revenue-generators.[23] But by 2010, over 150,000 applications were available for download from the App Store[24]; some 30,000 were available from Android's Marketplace.[25] These products are sometimes free, but also generate very substantial revenues via download fees and advertising. HAPs like Apple and Google share these payments with software developers (taking 30% in either case). This is a fee-for-service; the creation of a market in mobile software apps has been a boon to innovation at the edge. Small-scale software, content or wireless service providers gain ready access to a large customer base where users can easily find, obtain, and pay for their products.

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[22] See Section VI.

[23] Roger Cheng, *Wireless Cos' Control Of Web Access Helps Net, Irks Users*, DOW JONES NEWSWIRE (Feb. 4, 2007); http://www.cellular-news.com/story/21771.php

[24] Apple App Store website (visited May 5, 2010): http://www.apple.com/ipad/features/app-store.html.

[25] Casey Chan, *Android Market has 30,000 apps, sort of*, ANDROID CENTRAL (Mar 18, 2010); http://www.androidcentral.com/android-market-has-30000-apps.

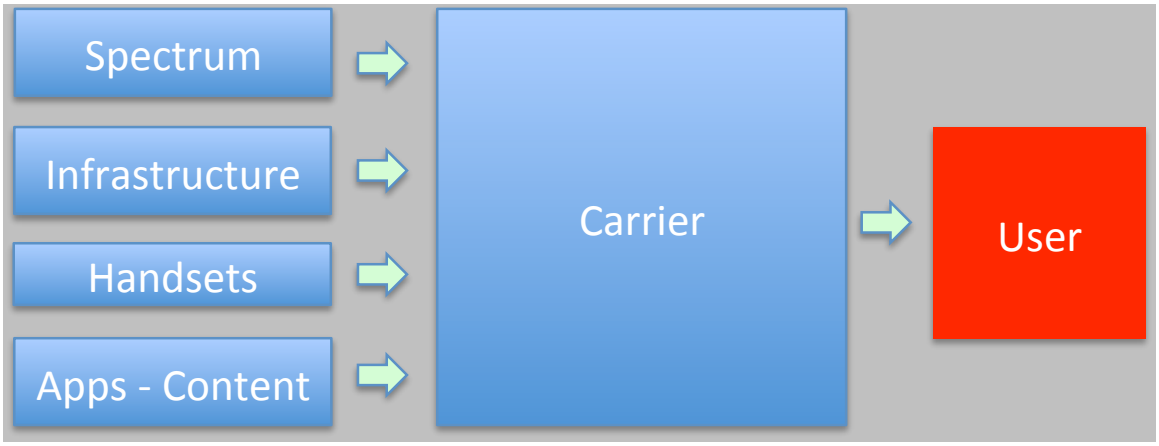

FIG. 1. TRADITIONAL MARKET ORGANIZATION IN U.S.A. MOBILE MARKETS

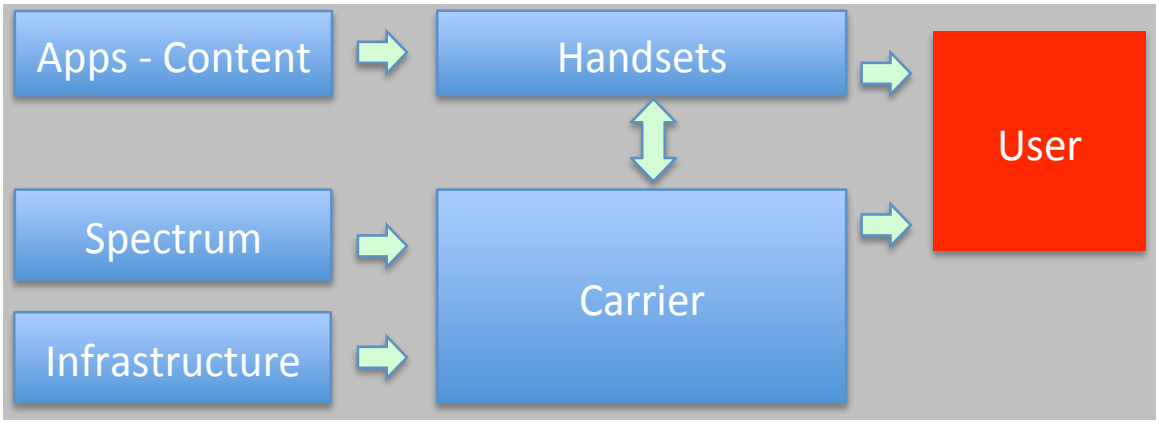

FIG. 2. EVOLVING ORGANIZATIONAL STRUCTURE AS HAPS COME TO U.S.A. MOBILE MARKETS

This structure has thus moved mobile applications from the domain of the carrier to, in large measure, the domain of the handset vendor – Apple, RIM or, in Google's case, the mobile operating system[26]. Competitive forces have forced carriers to cede such control. Customers want smart phones and other advanced mobile devices, and innovation platforms outside the carrier space have arisen to supply them. These platforms bundle the best of these devices with vertically integrated app stores. The HAPs compete directly with each other, while simultaneously cooperating and competing (for rents) with carriers.

RIM Blackberry pioneered this business model in the USA circa 1999. It focused on high-revenue enterprise customers, producing handsets with keyboards for text communications and mobile network overlay to quickly forward email messages to

[26] Google controls the kernel of the Android mobile operating system. While it allows customization of certain functions and applications embedded in the software, this allows the firm to organize the Open Handset Alliance wherein hardware (phone) makers license Android, obtain carrier access deals, and market handsets to end users. It also leaves Google a cut of the revenue stream for Android applications.

mobile devices even in the low-bandwidth (2G) networks then available. This niche specialization developed a loyal clientele among business users; even the president-elect of the United States admitted to being a "Crackberry" in 2008. By then, however, the Apple iPhone had been developed as a mass-market smartphone designed to take advantage of emerging 3G (broadband) networks. The enormously popular new device, was introduced in 2007, a smart phone bundled with (sole) access to its Apple App Store. It also chose an exclusive U.S. carrier, AT&T, extracting (as we show below) considerable network rents.[27] Then, reacting to Apple, Google created a mobile operating system and organized the OHS to bring partners in for the manufacture and sale of handsets – which quickly adopted the touch screen innovation brought to market by the iPhone.

Each of the HAPs has distinct rules and structure. RIM is more prone to control applications than Apple, but not as interested in exclusive carrier deals. Google aims to be the most "open," but still controls the operating system core, implants Google applications (such as search) as the default features of that system, and claims a share of revenues from apps supplied by third party developers. Innovation appears to come in all types of integration structures with varying degrees of 'openess' or 'closedness.'[28]

Consistent with the "profiting from technological innovation" (PFI) framework (Teece 1986), market structure appears to be shifting economic power from the networks to the complements. Wireless carriers created the basic platform for mobile communications, sinking considerable financial capital into fixed assets. In their oligopolistic rivalry, however, they seem powerless to resist the flow of revenues to those who provide popular smart phones or operating sytems. AT&T shares did not visibly react to the deal it struck for exclusive carriage of the iPhone in 2007; Apple's shares suggest a positive bump equal to at least $30 billion in incremental capitalization (Hazlett 2011). This profitability stems from the unique and innovative features of the iPhone and the difficulty competitors have had in imitating Apple's technology, partly due to Apple's intellectual property, but also because of its company culture, and brand.

Not all eco-system participants or device manufacturers prosper, of course. As noted, Nokia's fortunes have plummeted. In 2006, it was by far the market leader in smartphone units and in the most extensive ecosystem, based on mobile operating system, Symbian.[29] In 2011, however, Nokia's share of the smartphone market

[27] Apple markets iPhones via exclusive carrier deals in some countries, but not others, and may switch strategies (as in the U.S.A., which went from exclusive iPhone carriage in 2007 to multiple carriers in 2011).

[28] Barnett 2010 argues that these varying degrees of openness are the result of firms' dealing with the 'platform's dilemma.' We see the varying degrees of openness as a result of platform rivalry and innovation.

[29] Barnett (2011) explains the interesting strategy by which Nokia elected to give away extensive and seemingly valuable proprietary ownership rights in the Symbian operating system, moving to an "open source" framework.

(based on units shipped by operating system) fell below that of the surging Android software platform, and had declined by half in just the previous year. Nokia responded by abandoning Symbian and embracing, instead, the Windows operating system. In this alliance with Microsoft, Nokia is paid billions of dollars, as its large embedded base of Nokia users gives Microsoft instant access to a well-populated ecosystem. It is very interesting to note that despite owning the dominant operating system for personal computers, Microsoft has yet been no more than a niche player in mobile phones.

Three important lessons can be gleaned from this ongoing shift in the organization of the mobile marketplace.

- First, competitive rivalry can be made more robust by integrated structures that bring innovations and efficiencies to the market. The observed industrial integration helps to spur both growth in networks and innovation at the edge. Hence, categorical restrictions on vertical integration are likely to be counter-productive.
- Second, the evolving wireless ecosystem displays important clues as to how vertical integration helps to coordinate investors, innovators, and consumers in a chain of production.
    - Efficiency does not tend to migrate to corner solutions, categorically "open" or "closed" market structures, but to varying degrees of vertical integration and platform coordination.
    - Rivalry among these alternative business models then provides networks, third-party application and content developers, and end users valuable choices; those selected help reveal superior models over time.
- Third, financial returns are shifting within the industry. With disruptive innovation in handsets, in software, and content, profits are flowing away from networks and towards entrepreneurial firms providing complements that ride over the networks.

Elaborating on this latter point, Dedrick, Kraemer & Linden (2011) examine the distribution of value in the mobile phone supply chain. They estimate gross and net profits for four handset makers, Motorola, Nokia, Palm, and RIM, and three US carriers, Cingular, Sprint and Verizon Wireless. Net operating profit margins for the device vendors were 13.5%, as against 12.7% for the three US wireless carriers. But that ignores capital outlays. They estimate return on assets, which takes investment into account, to average 17.3% across the handset makers, and just 2% across the carriers.[30] This distinct tilt in industry rents – calculated prior to the presumably far more powerful assault on industry returns by the Apple and Google ecosystems --

[30] Returns for Palm, the authors note, may be inflated by one-time cash flows; dropping Palm yields a mean return for handset makers equal to 15.3%. The carriers' returns are estimated to be 1% for Cingular and 3% for Sprint, while the return on assets for Verizon Wireless could not be calculated. (Dedrich, Kraemer & Linden, p. 516)

underscores a "carrier's dilemma" in sinking capital to create wireless communications systems.

Data from capital markets strongly support this conclusion. Table 1 displays *q ratios* for the one publicly listed "pure play" U.S. wireless carrier, Sprint, and the major non-carrier mobile platform suppliers, RIM and Apple, as well as leading handset makers Motorola and Nokia. Since q = (market value)/(replacement cost of tangible assets), highly competitive market conditions constrain $q \approx 1$. Sprint, however, is valued at substantially below its capital cost, as is handset maker Motorola. Handset Applications Platform creators Apple and RIM, however, exhibit above-market returns, as does technology input supplier, Qualcomm.

TABLE 1. SELECTED Q RATIOS FOR WIRELESS ECOSYSTEM PLAYERS

Security	*2008*	*1Q2009*	*2Q2009*	*Ratio to SP500 (2Q2009)*	*Enterprise Value ($bil.; 5.4.10)*
Sprint	.6	.6	.5	0.68	28.9
Apple	2.6	2.5	3.1	4.25	212.2
RIM	5.0	4.6	6.2	8.49	~38.5
Nokia	1.0	.9	1.2	1.64	~41.5
MOTO	.7	.5	.3	0.41	11.7
QCOM	2.5	2.7	3.2	4.38	50.7
S&P 500	.55	.61	.73	1.0	

Source: Manual of Ideas (Sept. 21, 2009).

In Table 2 we use a slightly different approach, allowing an expansion of the inquiry. We examine enterprise values (EVs) for seven U.S. mobile networks against the market value of the wireless products owned by Apple. We make this intra-firm delineation, separating Apple's EV into "wireless" and "non-wireless" components (the latter not being of interest here), employing a recent Needham & Co. analysis attributing Apple's profits to its key product lines.[31] The "wireless Apple" valuation is generated by the iPhone and iPad.

[31] As reported in: Tiernan Ray, BARRON'S TECH TRADER DAILY (Aug. 5, 2011); http://blogs.barrons.com/techtraderdaily/2011/08/05/apple-needham-ups-target-to-540-ipad-to-hold-share/.

TABLE 2. U.S. MOBILE SECTOR MARKET VALUE, INCLUDING APPLE IPHONE/IPAD

Company	*$ Share Price (at close 8-16-2011)*	*Enterprise Value ($B)*	*Wireless Share*	*Wireless Value ($B)*
Verizon	34.88	145.88	~½ (by revenue)	78.5
AT&T	28.79	233.35	~½ (by revenue)	73.4
Sprint	3.59	25.01	~100%	25.0
T-Mobile	n.a.	39.0		39.0
MetroPCS	11.20**	6.7		6.7
Clearwire	2.33**	3.8		3.8
Leap	9.68	3.3		3.3
7 U.S. Mobile Carriers				229.7
"Apple Wireless"	380.5	324.3	~61.4% (by value)	199.1

Source: Share price and EV data from Yahoo!Finance (Aug. 17, 2011). Verizon Wireless and AT&T Mobility valued at market value per subscriber taken in subscriber-weighted average of Sprint and T-Mobile (=$768.31). Subscriber estimates as publicly reported for fourth quarter 2010. Note that 45% of Verizon Wireless is owned by Vodafone, lowering EV of parent firm (Verizon), but not of the estimated value of VZW in chart. *Announced price of AT&T take-over bid for T-Mobile. **Close on 8.17.11.

As seen in Table 2, the value of "wireless Apple" is far greater than any of the mobile networks; indeed, its EV is about 87% as large as the top seven mobile carriers combined – effectively, the entire wireless operator sector. These shifting fortunes were recently illustrated when Apple made the iPhone 4 available for use on the Sprint network. Even with Apple making devices for competing networks (as in the U.S.A., where AT&T and Verizon Wireless also have the iPhone 4), each network must meet Apple's terms. The disruptive innovator – strategic owner of a wildly popular set of products and applications -- plays the carriers off against one another, extracting substantial rents. Sprint shares fell ten percent on the announcement of the iPhone 4 deal, which came with a steep commitment from Sprint: it must buy 30.5 million handsets for approximately $20 billion ($675 per phone) over four years. Analysts see this as a "bet the company" move by the wireless operator.[32] As one securities analyst wrote:

> We recently upgraded Sprint to neutral (from underperform) based on an already jaw dropping decline in their share price and on our lack of visibility into their upcoming 4G strategy. In retrospect, we should have waited. The reported terms under which they have finally gotten access to sell the iconic iPhone, if accurate, neatly illustrate just how weak Sprint's

[32] Joann S. Lublin & Spencer E. Ante, *Inside Sprint's Bet on iPhone*, WALL ST. JOURNAL (Oct. 4, 2011); http://online.wsj.com/article/SB10001424052970203405504576603053795839250.html?KEYWORDS=Sprint+iphone.

position really is.[33]

It is also important to note that the centrifugal forces delivering increasing economic power to the edge of networks include not just Apple but also Google, which created its hosted platform shortly after the iPhone appeared. Google's Android platform is similar to those created by Apple, RIM, Palm (now HP) and Nokia, in that it brings a non-wireless applications innovator (Google owning no spectrum or network assets[34]) into a key organizational role within the mobile ecosystem. In a crucial respect, Google is perfectly positioned to be a platform innovator: Google Search, with about 65% overall U.S. share[35] and an astounding 97% share of U.S. mobile search,[36] is an extremely effective tool for monetizing handset usage. So long as Google maintains the default search engine on smartphone operating systems, and there is little incentive for customers to switch to rivals' apps, promoting handsets that increase mobile web usage increases Google profits.[37]

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[33] Craig Moffett, *Sprint: Be Careful What You Wish For*, BERNSTEIN RESEARCH (Oct. 5, 2011), p. 1.

[34] Actually, Google is an investor in Clearwire, a wireless broadband (4G) service supplier aligned with mobile operator Sprint (which owns about half of Clearwire). The development of Android, however, has little to do with this integration, as it is aimed at producing devices and applications for use on established mobile networks in the U.S. and globally.

[35] *Google Market Share by Country* (March 13, 2011); http://www.chandlernguyen.com/2011/03/search-engine-market-share-by-country-mar-2011.html

[36] Claire Cain Miller, *Google, a Giant in Mobile Search, Seeks New Ways to Make It Pay*, NY TIMES (April 24, 2011); http://www.nytimes.com/2011/04/25/technology/25mobile.html.

[37] While Google's terms are not transparent, being proprietary in agreements with hardware makers in the Open Handset Alliance, some details have emerged in court documents. Google must approve all devices running Android, giving it leverage as to the way its software is used and handsets or tablets configured. "Android might be open-source, but **Google maintains tight control over its OEM partners by restricting access to apps** like Gmail, Maps, and Market with a strict license agreement that hinges on Android compatibility… **Android devices are "approved essentially at Google's discretion,"** and that Moto[rola] couldn't afford to risk its relationship with Google. Motorola also [said] that its carrier agreements require Google's apps be preloaded on its phones, so Google's compatibility decision was doubly important — if Motorola shipped software that didn't have Google's blessing (and apps), it would immediately violate its contracts with carriers." Nilay Patel, *How Google Controls Android: Digging Deep Into the Skyhook Filings*, THISISMYNEXT.COM (May 12, 2011) (emphasis original); http://thisismynext.com/2011/05/12/google-android-skyhook-lawsuit-motorola-samsung/.

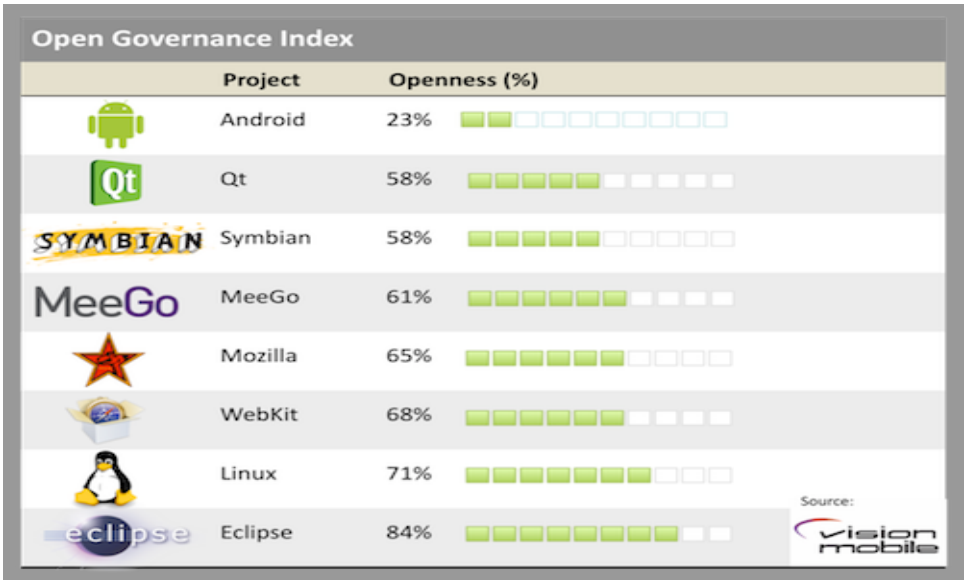

FIG. 3. RANKING "OPEN SOURCE" SOFTWARE FOR "OPENNESS"[38]

This rent capture mechanism has made Google both a fierce HAP competitor, investing in the development of Android as a fully competitive smartphone operating system and organizing the Open Handset Alliance to produce devices running Android, and champion of a relatively "open" platform. Google's proprietary interests, protected in the Googleware that makes their search engine dominant (Vise & Malseed, 2005),[39] push the firm to be relatively generous in the terms established for producers of complements. For instance, the Android O.S. has been licensed to manufacturers like Samsung and Motorola without charge.[40] The Android software kernel is copyrighted and owned by Google, but operators, app developers, or users can customize it as in an "open source" environment.[41] Vertical services are freely available for Google Android users or handset vendors, either through Google Market, which the search firm runs (and takes 30% of revenues), or through competitors. Compared to the highly organized Apple iOS platform,

[38] Liz Laffan, *A New Way of Measuring Openness, From Android to Webkit: The Open Governance Index [Updated]* VISIONMOBILE (July 29, 2011); http://www.visionmobile.com/blog/2011/07/the-open-governance-index-measuring-openness-from-android-to-webkit/. See also, Ryan Paul, *Study: Android is least open of open source mobile platforms*, ARS TECHNICA (Aug. 3, 2011); http://arstechnica.com/open-source/news/2011/08/study-android-is-least-open-of-open-source-mobile-platforms.ars.

[39] Android licensing terms explicitly guard against appropriation of Google's rich portfolio of Internet services, as revealed when Android licenses were made public in a recent court case. "Android might be open, but Google's apps certainly aren't: the license forbids anyone from reverse engineering or otherwise trying to 'learn the source code or algorithms' of Google apps. Yes, we all already assumed this, but now we have proof in black and white." Nilay Patel, *How Google Controls Android: Digging Deep Into the Skyhook Filings*, THISISMYNEXT.COM (May 12, 2011); http://thisismynext.com/2011/05/12/google-android-skyhook-lawsuit-motorola-samsung/

[40] Claire Cain Miller, *Google, a Giant in Mobile Search, Seeks New Ways to Make It Pay*, N Y TIMES (April 24, 2011); http://www.nytimes.com/2011/04/25/technology/25mobile.html.

[41] Scott Gilbertson, *Is Android Open?* WIRED (Oct. 22, 2010); http://www.wired.com/epicenter/2010/10/is-android-open/.

Android seems like anarchy, yet it is subject to vertical control (by Google) more tightly than rival "open source" packages. See Figure 3. Android's mix of "vertical control" and "platform openness" forms a complementary fit with Google's portfolio:

> Google has made Android available at zero cost, since Google's core business is not software or search, but driving eyeballs to ads. As is now well understood, Google's strategy has been to subsidize Android such that it can deliver cheap handsets and low-cost wireless Internet access in order to drive more eyeballs to Google's ad inventory.[42]

While Google's interest in supporting its own mobile operating system was evident as early as 2005 (when the company bought Android, Inc. for an estimated $50 million[43]), Android phones started trickling to market in 2008,[44] clearly in response to market developments in which the "closed" Apple platform was the primary protagonist:

> … Android would not have risen were it not for the billions of dollars that OEMs and network operators poured into Android in order to compete with Apple's iconic devices. As Stephen Elop, Nokia's CEO, said in June, 2011, "Apple created the conditions necessary for Android."[45]

Indeed, the late Steve Jobs claimed that Google had appropriated the company's mobile business model, stealing key technical advances and the "look and feel" of the iPhone. Sharp tensions between the two firms – previously close allies – drove Google CEO Eric Schmidt to resign from Apple's Board of Directors in 2009.[46]

While starting slowly, indeed starting from scratch, the Android market was making enormous strides by 2009 (a) attracting handset makers such as Samsung, HTC, Motorola and LG to build Android phones; (b) striking deals with mobile carriers, beginning with the G1's debut on T-Mobile in 2008 but quickly extending to Verizon, AT&T,[47] and Sprint, to host Android phones; (c) encouraging third party software writers to create applications for Google Market and other websites, producing at least 500,000 apps by late 2011. This vibrant ecosystem both caused, and was caused by, the rapid growth in market share achieved by the Android operating

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42 Liz Laffan, *A New Way of Measuring Openness, From Android to Webkit: The Open Governance Index [Updated]* VISIONMOBILE (July 29, 2011); http://www.visionmobile.com/blog/2011/07/the-open-governance-index-measuring-openness-from-android-to-webkit/.

43 Ibid.

44 Brad Stone & Miguel Helft, *Apple's Spat With Google Is Getting Personal*, NY TIMES (Mar. 13, 2010); http://www.nytimes.com/2010/03/14/technology/14brawl.html?src=tptw&pagewanted=all.

45 Ibid.

46 Brad Stone & Miguel Helft, *Apple's Spat With Google Is Getting Personal*, NY TIMES (Mar. 13, 2010); http://www.nytimes.com/2010/03/14/technology/14brawl.html?src=tptw&pagewanted=all.

47 Tony Bradley, *AT&T Scores Another Win by Adding Android*, MSNBC.COM (March 8, 2010); http://www.msnbc.msn.com/id/35769584/ns/technology_and_science-wireless/

system. Barely registering on surveys of usage in through early 2009, Android passed RIM Blackberry, Apple iOS, and market leader Nokia Symbian by late 2010. See Figure 4.

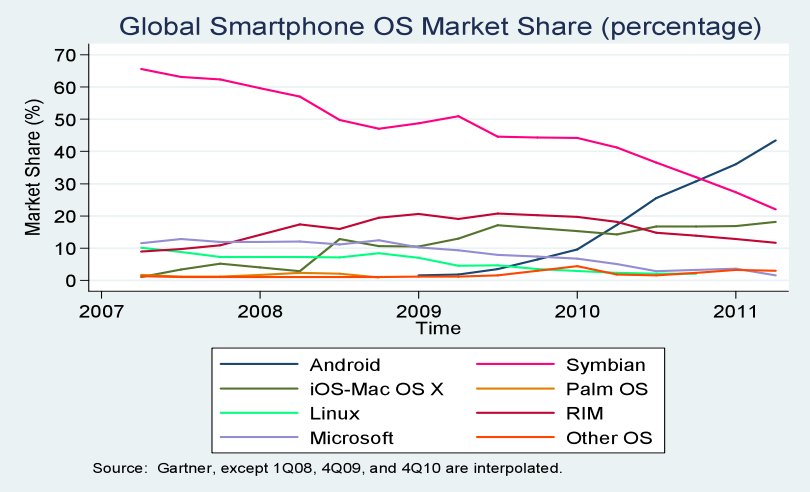

FIG. 4. GLOBAL SMARTPHONE OS SHARE (%, 3Q2007-2Q2011)

The rival models pursued by the leading mobile device platforms have distinct structures, each being a mix of "open" and "closed" features. Even among these designations, there are overlapping and ambiguous categorizations. RIM, "which arguably operates the most closed system with respect to its BlackBerry device" (Barnett 2011, p. 1920), has pursued an "all networks" marketing policy as opposed to Apple's strategic exploitation of exclusive deals for carriers who pay for the privilege. Google has eschewed vertical integration into hardware, unlike Apple, but maintains a revenue split in its app store equal to Apple's and a far larger presence (in terms of revenue generation) in software apps via its ownership of Google Search and associated advertising flows. Moreover, Google changed strategies in 2011 with its announcement that it would vertically integrate into handset manufacturing, purchasing Motorola Mobility, the world's third-largest cellphone maker.

The walled garden rivalry has produced an explosion in consumer choice, perhaps best seen in the stunning expansion of the smartphone market. Despite a steep global recession, 2007-2009, unit sales climbed dramatically – from less than 30 million units per quarter to more than 100 million. See Figure 5.

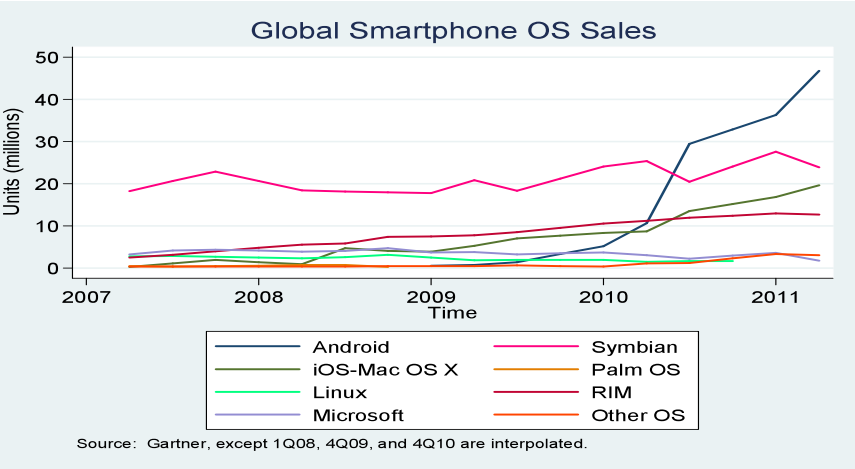

FIG. 5. GLOBAL SMARTPHONE UNIT SALES, 2Q2007-2Q 2011

The market continues to evolve. Undeterred by the intensity of rivalry among smartphone platforms, online retailer Amazon has nudged its Kindle e-reader into the fray. Eyeing an emerging market in network-connected tablets, pioneered by Apple's innovative iPad, Amazon has tweaked its book reading device to offer much of the functionality offered by tablets. Amazon's core competency is not in networks, software, or hardware, but online marketing, and seeks to leverage that position in devices. As of now, Apple's iPad (and iOS) dominate this niche, with two-thirds of the global market, with Android-based tablets capturing most of the rest, save for RIM's 5% (with the Playbook).[48] Yet, experience in cellphones and smartphones, not to mention PCs, suggests that such performance metrics are highly volatile.

[48] Phillip Elmer-Dewitt, *IDC: iPad Gained Market Share in Q2; Android Tablets Lost*, FORTUNE (Sept. 14, 2011); http://tech.fortune.cnn.com/2011/09/15/idc-ipad-gained-market-share-in-q2-android-tablets-lost/.

IV. WALLED GARDENS IN JAPAN AND EUROPE

It is instructive to return to the earlier, pre-smart phone generation of wireless. First generation mobile used analogue technology. Data applications generally became possible when second generation technology allowed for digital communications. Two competing standards arose. The first was a global standard called WAP (Wireless Application Protocol), was created in June 1997 by an industry consortium of Ericsson, Motorola, Nokia and Unwired Planet.[49] The other was pioneered by DoCoMo -- a subsidiary of NTT – which launched "i-mode" in Japan on February 22, 1999.

By 2001, while there were 640 million GSM phones worldwide outside Japan and Korea, only 64 million were WAP enabled and of that number less that 6 million used WAP regularly (Sigurdson 2001, p. 1).[50] In vivid contrast, by the end of 2001, 16 million Japanese subscribers were using DoCoMo's i-mode and about 9 million more the competing WAP services offered by DoCoMo's competitor and KDDI and J-phone. See Figure 6. So what went wrong in the West, why did an industry consortium with an early start do so poorly, and why was mobile internet so successful in Japan so quickly?

The answer is simple: i-mode was a business model that incorporated a well-coordinated (walled garden) ecosystem, a structural approach also adopted by DoCoMo's Japanese rivals, J-phone – and by KDDI which also deployed WAP technology. Elsewhere, WAP services lacked the complementary features necessary to execute the business model. [51] In some countries, notably the USA, carriers attempted to rebrand content or sell their own (e.g. ringtones), an effort that required reinventing the wheel. This was a "walled garden" approach, but a relatively unsophisticated one. DoCoMo controlled content providers in key dimensions, but allowed branded products to go straight to end users. The DoCoMo supplied walled garden proved a secure and nurturing environment in which these providers' mobile products could flourish.

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[49] By 1997, each of these four firms had their own specific procedures for data/web applications. The WAP Forum established standardised protocols

[50] This calculation assumes the number of active users as 10% of the 10% (of cellphone subscribers) who had WAP-enabled phones.

[51] A notable exception is Norway, where "[t]he basic strategy has been to stimulate content providers to create and market mobile services themselves by offering good revenue sharing business models and a well defined interface to offer their services." *American Operators could learn from Norway*, Strand Consult (2005); http://www.strandreports.com/sw633.asp.

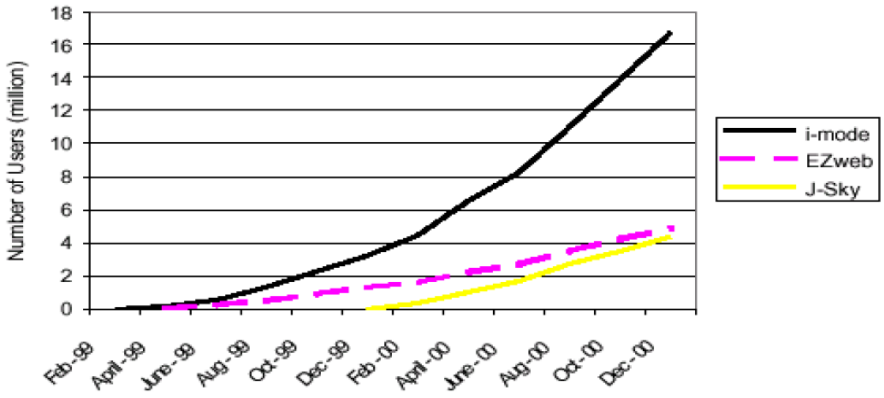

FIG. 7. TAKE-OFF GROWTH FOR JAPAN'S WIRELESS "WALLED GARDENS"[52]

> … i-mode is not a technology. I-mode is a business model, implemented by NTT DoCoMo using technologies freely available in the mid – 1990's … In addition, there are two other Japanese carriers – J-Phone and KDDI- who have successfully implemented the same business model using very different technologies, and each have captured 20% of Japan's wireless internet market. In fact, KDDI provides a WAP – based service, implemented on a Qualcomm-provided, cdmaOne network.[53]

The WAP Forum, established in 1997, developed a set of optimized protocols for running web content over a wide variety of cellular networks, equipment and mobile phones. The desire was to establish a universal open standard. By 1999, over 100 companies had joined (Sigurdson, p. 9). Early choices however limited WAP's usefulness. First and foremost, WAP did not use the standard web mark-up language of HTML but a proprietary Unwired Planet language - Wireless Mark Up Language. This meant that developers and applications/services providers had to use a proprietary language in addition to HTML. WAP 2 unveiled in 2002 used a version of HTML- xHTML and a WML extension module making it far easier for developers but too late! Few firms in the West were interested in redeveloping their web sites in WML; therefore mobile customers had poor experiences as non WML websites loaded slowly and poorly. In Japan, WAP was more successful, due to the business model that KDDI deployed (described below).

There were other severe problems with WAP – perhaps best known to consumers as "Wait and Pay. " One of these was technological. Until GSM networks moved to a third generation standard called GPRS, data was not packet switched but circuit switched. This meant that once a circuit was established for data/web services, the user was charged regardless of the amount of data downloaded. Packet switching in

[52] George Bake & Veronique Megler, *The Semi-Walled Garden Japan's i-mode Phenomenon*, IBM Red Paper (Oct. 31 2001), p. 6; http://www.redbooks.ibm.com/redpapers/pdfs/redp0166.pdf.
[53] Ibid., p. iii.

contrast (now all mobile is packet switched), means that users can be charged not for the time online but for the amount of data downloaded.

A mobile operator offering data/web services and applications is essentially an intermediary linking users with service providers through a network and a device. All parts of the value chains need to be integrated for effective services. DoCoMo established such an ecosystem.

.[54]

Takeshi Natsuno, the driving force behind i-mode, has recalled that the i-Mode development team visited San Francisco in December 1997 to see how U.S. operators were deploying WAP services. The trip convinced them that the approach was a disaster – attractive, easily available content that was entirely lacking. Hence DoCoMo decided to take an active hand in supplying web applications – vertically integrating, by contrast -- and to abandon WAP in favor of a version of HTML (Sigurdson, p. 28). DoCoMo worked with phone manufacturers to insert an i-Mode button on handsets – one-touch to access the Internet. (Operators in the U.S.A. and Europe were far less active in mobile device design.) This button made for quick and easy customer access to a group of preferred content providers. A content or application firm had to apply to be included on the i-Mode list of applications and services. DoCoMo imposed strict specifications for how websites would interface with mobile subscribers (critically important in the bandwidth-constrained 2G network), and also examined content to ascertain if suppliers were delivering the products they promised. "All i-Menu content is authorized by NTT DoCoMo, while quality is maintained by setting high operability standards and offering quality services."[55]

In addition, DoCoMo set maximum (retail) charges for any service on its official menu. It also encouraged competition between applications. One of the authors visited DoCoMo in 2004 and asked how the order of listing of providers was chosen. The answer: consumer selection. The ordered list of ringtone providers, e.g., was based on revenues. First listed was the most popular seller. DoCoMo established an intelligent user-driven walled garden.

The charge for the i-mode service was low – 300 yen (about US$3.) DoCoMo also introduced real-time balance information; a running tab was available for viewing on the handset. As data services were new, DoCoMo did not want customers to

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[54] "We collaborate closely with equipment manufacturers, content providers, and other platforms to ensure that wireless technology, content quality, and user experience evolve jointly. This synchronization guarantees that customers, partners and shareholders share interests with end-users, thus enabling all parties to maximize value and to continue to improve the quality of products and services connected with i-mode." www.docomo.com.

[55] www.docomo.com.

suffer "bill shock" when an unexpectedly large invoice appeared at the end of the month.[56]

DoCoMo billed users for all third-party i-mode services, taking 9% of revenues as its fee. This sharply decreased entry barriers for third party developers; they did not have to create their own billing systems. Overall, DoCoMo's business model was wildly popular with developers "at the edge." By 2001, there were some 1800 content providers on the i-mode platform.[57] Any other Internet website could be accessed via their URL. However, such unofficial sites did not appear on the i-Mode menu, were slower to download, and had to make their own billing arrangements.

That the "walled garden" was a hit with developers and with consumers was evident. This seemed to mystify foreign observers whose priors led them to categorically prefer "open" platforms. In 2001, Wired Magazine expressed just such a confusion.

> So far, the wireless Internet has flopped spectacularly in every part of the world except Japan. WAP, the wireless application protocol that was supposed to put cell phone users on the Internet in the US and Europe, is memorable mainly for having inspired the slogan "WAP is crap." Yet i-mode, introduced with minimal expectations in February 1999, has attracted more than 25 million subscribers - one-fifth of Japan's population.
>
> At the heart of all this is a paradox: i-mode depends on outside providers for everything from handsets to content, yet it's managed so carefully that nothing is left to chance. Critics see a walled garden, more mobile mall than wireless Web. But in fact, i-mode's success comes less from being walled than from being obsessively tended. [58]

But there is no paradox. "Obsessive tending" often pays very large returns -- for innovators, complements, and consumers.

V. Summary and Conclusion

Mobile telephony illustrates important emerging phenomenon with respect to competition in the knowledge economy. First, the underlying infrastructure providers – the networks – are having problems garnering profits from their

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[56] DoCoMo also introduced controls on some games to limit usage.

[57] IBM, op. cit.

[58] Frank Rose, *Pocket Monster*, WIRED (2001); http://www.wired.com/wired/archive/9.09/docomo.html.

investments, fundamentally because of intense competition and the absence of strong points of differentiation. Nevertheless, network providers have enabled significant innovation in devices and new services for the end users.

With respect to end users, a similar story is being told. The device manufacturers aren't as profitable – nor should they expect to be – as the ecosystem creators (and "managers") who have made the investments inside walled gardens. These gardens are properly watered by the system provider. Customers want to enjoy all the fruits from the garden and so enter the gates to get inside the walls. Competition flourishes between gardens, but not inside walled gardens. The virtues of such (vertical integration) are apparent. Alfred Chandler lives behind the walls while Joseph Schumpeter enjoys keeping it windy and chilly outside!

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