

Business ecosystems and the view from the firm

BY JAMES F. MOORE*

I. Introduction

For more than sixty years, markets and hierarchies have dominated our thinking about economic organization¹. This paper suggests that a third form, the ecosystem organizational form, has now become so important in practice that it should be accorded equal recognition in theory and in policy-making. Markets, hierarchies and ecosystems are the three pillars of modern business thinking, and should provide the foundation for competition policy, regulation, and antitrust actions. I am pleased to contribute to this issue of the Antitrust Bulletin as a member of the American Antitrust Institute Invitational Roundtable on Complexity, Networks and the Modernization of Antitrust.²

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¹ The classic statement of markets and hierarchies as the two primary forms of economic organization is by Ronald H. Coase, *The Nature of the Firm* (1937) reprinted in OLIVER E. WILLIAMSON & SIDNEY G. WINTER (eds.), *THE NATURE OF THE FIRM: ORIGINS, EVOLUTION, AND DEVELOPMENT* (1991; subsequent economic policy study based on this dichotomy is surveyed in WILLIAMSON & WINTER (ibid.) and its systematic implications for antitrust in OLIVER E. WILLIAMSON, *MARKETS AND HIERARCHIES: ANALYSIS AND ANTITRUST IMPLICATIONS* (1975).

² AAI Invitational Roundtable on Complexity, Networks and the Modernization of Antitrust, American Antitrust Institute, April 26, 2005.

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The ecosystem form of economic coordination has become pervasive on the business landscape.³ Business ecosystems surround, permeate, and reshape markets and hierarchies. Managers establish business ecosystems to coordinate innovation across complementary contributions arising within multiple markets and hierarchies. The activities of business ecosystems set the agenda for “co-evolution”⁴ of markets and hierarchies and their outputs.

The focus of companies in most sectors has progressed from competing on efficiency and effectiveness to competing on the basis of continuous innovation. As companies have accelerated innovation in their own businesses, they have discovered that they can’t change the world alone. For every advance there are complementary innovations that must be joined in order that customers can benefit. These complementary advances often must co-evolve across company lines because no single firm has all of the required specialized knowledge and managerial resources necessary for the whole system. Indeed, a substantial solution to a customer need may require the

³ For comprehensive treatment of the business ecosystem organizational form and its applications, see JAMES F. MOORE, *THE DEATH OF COMPETITION: LEADERSHIP AND STRATEGY IN THE AGE OF BUSINESS ECOSYSTEMS* (1996); and MARCO IANSITI & ROY LEVIEN, *THE KEYSTONE ADVANTAGE: WHAT THE NEW DYNAMICS OF BUSINESS ECOSYSTEMS MEAN FOR STRATEGY, INNOVATION AND SUSTAINABILITY* (2004).

⁴ Co-evolution is a core concept in studies of complex adaptive systems and the economy, focusing attention on reciprocal cycles of adaptation among one or more elements of an economic system. Uses of the term in business and economics range from the highly abstract and mathematical, to the empirical. For a mathematical treatment see PHILIP W. ANDERSON, KENNETH J. ARROW, DAVID PINES (ed), *THE ECONOMY AS A COMPLEX ADAPTIVE SYSTEM* (1988). Strategists such as MOORE (1996) op. cit., and IANSITI & LEVIEN (2004) op. cit. provide detailed empirical descriptions of co-evolution in action, demonstrating reciprocal interactions among technologies, business processes, products and services, market mechanisms, firm and ecosystem structures, and policy and regulation. CARLISS Y. BALDWIN & KIM B. CLARK, *DESIGN RULES: THE POWER OF MODULARITY* (2000) present highly detailed and fascinating studies of co-evolution between technical modularity in products, and the networks of firms that arise to produce them.

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participation of dozens or even hundreds of diverse contributors, each of which is a master of fast-moving, complex and subtle developments in its own domain.⁵

A senior executive might say “we need to promote a business ecosystem around our new product” or “the iTunes ecosystem is becoming important for our company” or “our business ecosystem is becoming more standards-based and open.” The term “business ecosystem” and its plural, “business ecosystems,” refer to intentional communities of economic actors whose individual business activities share in some large measure the fate of the whole community. Companies making accessories for the Apple iPod can be said to be members of the iPod business community or, more evocatively, the iPod business ecosystem. The same can be said of the entertainment companies that license music through iTunes, the iPod-connected music downloading site, as well as the consumers who purchase and enjoy the music.

A business ecosystem, as we will see, can also be conceived as a network of interdependent niches that in turn are occupied by organizations. These niches can be said to be more or less open, to the degree to which they embrace alternative contributors. One of the most exciting ideas in business today is that business ecosystems can be “opened up” to the entire world of potential contributions and creative participants.

In order for companies to co-evolve their goods and services, they must find ways to align their visions, so that research and development investments are mutually

⁵ For a discussion of how innovation is coordinated by the business ecosystem organizational form, see James F. Moore, *Predators and Prey: A New Ecology of Competition*, HARVARD BUSINESS REVIEW, (1983)

⁸ A seminal study of the failure of firms and/or markets to achieve such coordination and the rise of ecosystem-style “flexible specialization” is MICHAEL J. PIORE & CHARLES F. SABEL: THE SECOND INDUSTRIAL DIVIDE: POSSIBILITIES FOR PROSPERITY (1984)

supportive, and capital investments and operating processes are synergistic. Companies must establish interfaces and protocols for putting together their contributions. Most important they must dialogue closely with customers so that what is created is what the customer wants and is willing to pay for. Mastering these challenges, of what might be called “distributed creativity,” is the aim of the ecosystem organizational form. The conventional hierarchical firm does not effectively address the breadth and importance of inter-firm relationships. The unaided market is not able to achieve inter-firm coordination sufficient to justify players aligning their dreams, plans, and product road maps.⁸

Courts and regulators need to recognize the ecosystem form, appreciate its nature, structure and operation, and seek to support its contributions to pro-competitive and pro-innovative social outcomes. Antitrust cases that do not recognize this level of organization run the risk of ignoring and possibly damaging important collaborative, innovation-furthering public goods. Cases also run the risk of being used by opponents of a particular business ecosystem to undermine the effectiveness of an innovating community, thus making the courts unwitting tools of narrow competitive interests and inadvertently impairing collective advances that might benefit the whole society. In instances when leaders of business ecosystems seek to use their power in predatory or narrowly collusive ways, it is vital that regulators and courts be able to “connect the dots” and understand why particular actions are being undertaken, and what their likely anti-competitive consequences are.

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Yet it is often difficult for outsiders to the executive suite to connect the dots, to recognize business ecosystem leadership in action. From my experience, there are three principal reasons. First, companies keep their strategies secret. Even close stakeholders such as investors and employees are often in the dark about how various imperatives are intended to fit together. This can be particularly true of ecosystem-influencing initiatives, as they are aimed not only at leading the internal processes and people of the company, but include shaping the behavior of groups and organizations that are outside of the company boundary. Second, even when executives are willing to share their strategies, they often are acting intuitively or with only a partial understanding of their own actions. I know one major Silicon Valley firm that used maxims from the “Smith method” of driver education as strategic touchstones: “Get the big picture,” “aim high in steering,” “leave yourself an out,” “keep your eyes moving,” “look ahead for trouble” were the explicit guidelines of a sophisticated but largely unarticulated ecosystem-shaping strategy.

Third, traditional economic theory does not focus on business ecosystems as a distinct form of organization, and does not provide conceptual templates that can be used to detect, inspect, and assess business ecosystems. By contrast, when it comes to markets and hierarchies, courts and policy makers benefit from years of systematic research describing ideal markets and firms, market failures, and failures of organization. They also have at hand a history of explicitly described regulatory and antitrust interventions

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and outcomes.⁹ It would be useful to have equivalent models of idealized business ecosystems, as well as theories of “business ecosystem failures” through which actions and effects in a case can be examined, and for which remedies can be devised and tried.

All three causes of invisibility are now being remedied. Ecosystem-affecting strategies are being described and discussed by business journalists, insiders, and scholars. Inside executive suites, business ecosystem strategy-making is becoming more of a conscious, disciplined process: articulate, structured, and analytical. The systematic study of business ecosystems and related ideas has moved to the forefront of literature and scholarship in business strategy¹⁰, marketing¹¹, research & development and the design of products and services¹².

⁹ As Gregory Gundlach emphasizes, antitrust activity in the United States has until the last few years dominated by the Chicago School approach, which seeks quantification and simplicity in its focus on markets and market power, and tries to avoid more subjective findings of fact and inductive definitions of market power and the public good. This philosophical and methodological commitment, while having its merits in reducing the direct costs of antitrust enforcement, makes it difficult to bring new facts and theories to the table, and would seem to make it more difficult to gain recognition for the business ecosystem form. The post-Chicago School, by contrast, embraces a more grounded, empirical, and eclectic methodology, which would seem to favor careful description and analysis of the ecosystem form. Gregory T. Gundlach, “Marketing and Modern Antitrust Thought,” in PAUL N. BLOOM & GREGORY T. GUNDLACH, *HANDBOOK OF MARKETING AND SOCIETY* (2001).

¹⁰ In addition to MOORE, *op. cit.*; and IANSITI & LEVIEN, *op. cit.*; see WILLIAM H. DAVIDOW & MICHAEL S. MALONE, *THE VIRTUAL CORPORATION: STRUCTURING AND REVITALIZING THE CORPORATION FOR THE 21ST CENTURY* (1993); RICHARD A. D’AVENI, ROBERT GUNTHER, JONI COLE, *STRATEGIC SUPREMACY: HOW INDUSTRY LEADERS CREATE GROWTH, WEALTH, AND POWER THROUGH SPHERES OF INFLUENCE* (2001); ANDREW S. GROVE, *ONLY THE PARANOID SURVIVE: HOW TO EXPLOIT THE CRISIS POINTS THAT CHALLENGE EVERY COMPANY AND CAREER* (1996); DON TAPSCOTT, ALEX LOWY, DAVID TICOLL (eds.), *BLUEPRINT TO THE DIGITAL ECONOMY* (1998); and ADAM M. BRANDENBURGER & BARRY J. NALEBUFF, *CO-OPETITION* (1996).

¹¹ The classic references on marketing complementary products and services in high technology businesses are REGIS MCKENNA, *THE REGIS TOUCH: NEW MARKETING STRATEGIES FOR UNCERTAIN TIMES* (1986), and GEOFFREY A. MOORE, *CROSSING THE CHASM (REVISED)*, (2004). A striking book that focuses on how distributed value creation empowers customers is ZUBOFF, SHOSHANA & MAXIM, JAMES, *THE SUPPORT ECONOMY: WHY CORPORATIONS ARE FAILING INDIVIDUALS AND THE NEXT EPISODE OF CAPITALISM*.

¹² A rich and detailed analysis of the way that domain specialization in innovation leads to product, process, organizational and industry structure modularization is found in CARLISS Y. BALDWIN & KIM B. CLARK, (2000) *ibid.*; A number of scholars have explored the open source software movement, peer

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Legal scholars have taken up the charge. Perhaps the most promising work is being accomplished in the still young field of Internet law. Researchers are analyzing the impact of such ideas as open media, open systems, open standards, open networks, open spectrum, and the evolution of the open source software movement and similar systems of community “peer production” of information goods¹³.

It is thus appropriate that as we seek to modernize antitrust law and competition policy, business ecosystems should be considered carefully, and their public costs and benefits examined. Most important, government agencies and courts need to be able to interpret and evaluate the impact of specific tactics that participants use in business ecosystems, especially initiatives intended to shape collective action across the community. In some cases, we may conclude that tactics that seem on first glance coercive, collusive or discriminatory in fact serve the public interest. On the other hand, tactics that seem on their face to be open and inclusive may be discovered to have detrimental consequences, either by design or by accident.

production, and open, distributed creativity, including HENRY WILLIAM CHESBROUGH, *OPEN INNOVATION: THE NEW IMPERATIVE FOR CREATING AND PROFITING FROM TECHNOLOGY*; STEVEN WEBER, *THE SUCCESS OF OPEN SOURCE* (2005); ERIC VON HIPPEL, *DEMOCRATIZING INNOVATION* (2005); ERIC S. RAYMOND, *THE CATHEDRAL & THE BAZAAR: MUSINGS ON LINUX AND OPEN SOURCE BY AN ACCIDENTAL REVOLUTIONARY* (2001); Work in economic geography tends to focus less on business ecosystems as systems, than on geographic proximity and ethos as a support for ecosystem forms of organization. An insightful study of this type is by ANNALEE SAXENIAN, *REGIONAL ADVANTAGE: CULTURE AND COMPETITION IN SILICON VALLEY AND ROUTE 128* (1994)

¹³ Much of the relevant legal scholarship focuses on regulatory and legal barriers to the most open of the business ecosystem forms, particularly in telecommunications and media, and computer software. Yochai Benkler, *Coase's Penguin, or Linux and the Nature of the Firm*, 112 *Yale Law Journal* 369 (2002); Yochai Benkler, *The Battle Over the Institutional Ecosystem in the Digital Environment*, 44 *Communications of the ACM* No.2 84 (2001); LAWRENCE LESSIG, *FREE CULTURE: HOW BIG MEDIA USES TECHNOLOGY AND LAW TO LOCK DOWN CULTURE AND CONTROL CREATIVITY* (2004); WILLIAM FISHER, *PROMISES TO KEEP: TECHNOLOGY, LAW, AND THE FUTURE OF ENTERTAINMENT* (2004); Jonathan Zittrain, "Normative Principles for Evaluating Free and Proprietary Software" . *University of Chicago Law Review*, Vol. 71, No. 1 (2003).

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My hope in writing this paper is to describe the reality of business ecosystems so that members of the judicial system and policy-makers can better walk in the shoes of the executives and firms they seek to understand. First, I examine the origins of modern business ecosystems. Next, I consider public goods created by the ecosystem form. In part I do this to counter a tendency in the courts today to attack ecosystems and their mechanisms of coordination piecemeal, rather than to address their strengths and weaknesses whole. The fourth section of this paper considers some ways the business ecosystem form may be abused, and for which explicit competition policy and antitrust remedies may be required. In the end, I believe the ecosystem form of organization has profound social and economic consequences. It is important that we address its special nature as clearly and sensitively as possible, in order to reinforce its value and remedy its deficiencies.

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II. Milestones in the history of business ecosystems

No organizational form emerges out of whole cloth. Approaches to organization are invented, experimented with, refined, and shaped by happy and not-so-happy accidents. The modern multidivisional firm was invented largely in the automobile industry in the first third of the twentieth century, was immensely advanced by Pierre S. DuPont and Alfred P. Sloan, Jr., and written about by their brilliant chronicler Alfred Chandler. The challenge of early 20th century industry was, as Chandler has written, managerial control.¹⁴ The auto industry was the paradigm of this task, a capital-intensive business with multi-year product cycles, massive retooling for each generation of cars, and a semi-skilled labor force of thousands.

There indeed were automobile-centric business ecosystems, but no theory of their development has been recorded. A variety of complementary goods were necessary for cars to be useful: roads, gasoline service stations, retailers, as well as steel makers and component manufacturers such as tire makers and chassis builders. The biggest organizational challenges facing the industry were not the coordination of these complementary assets, which took years to establish and were relatively simple to envision, but rather the efficient running of armies of men and vast combines of machines, epitomized by Detroit's integrated auto production facilities.

¹⁴ ALFRED D. CHANDLER, *STRATEGY AND STRUCTURE: CHAPTERS IN THE HISTORY OF THE AMERICAN INDUSTRIAL ENTERPRISE* (1969). ALFRED D. CHANDLER & STEPHEN SALISBURY, *PIERRE S. DU PONT AND THE MAKING OF THE MODERN CORPORATION*. (1971)

By contrast the modern computer business grew from the seeds of semiconductors and software. Its core resources are not materials but complementary, systematically related ideas. And over the course of thirty-five years of making and managing these relationships, the executives of that sector have refined first a practice and then a theory of business ecosystems, and have gone to great lengths as well to share it with their clients and allies in other economic sectors. Thus, while business ecosystems have always been with us, the managed business ecosystem organizational form grew up in the paradigmatic innovation industry of the late 20th century: the high technology computer business.

How does one make a sustainable business of a profusion of ideas, an overwhelming richness of possibilities? How does one pull together a subset of advances into the design of a product or service capable of solving real human problems? How does one open that design to continuing advances in the various contributing sub-domains of knowledge? This is the challenge the business ecosystem meets.

A. IBM modularizes technology, and HP establishes a flexible organization

Two developments in the late 1960s, one technical and one cultural, were part of the beginning of business ecosystems as an explicit approach to organization design and industry structure. The first was the modular architecture of the IBM/360, and an early ecological form of industry structure. Much has been written about this massive computer project. For our purposes, what is important is that it was the first to embody a

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completely and explicitly modular architecture¹⁵. Distinct tasks that faced the total system, from memory to printing to instruction processing, were divided up into what can be thought of as niches in a network of niches.

In designing the IBM/360, separate teams focused mainly on their specialties, with their work related to that of others through simplified interfaces that hid the complexity on either side. This modular design enabled the building of the most powerful and fully featured computer system of its time, without the interactions of its functions becoming intractable. Moreover, the machine once constructed had parts that could be interchanged and extended if one understood the interfaces among them.

As Baldwin and Clark report,

..this new modular task structure in turn carried within it the seeds of new enterprise designs. In December 1967, less than a year after the new task structure became a reality, twelve employees left IBM's San Jose laboratory to form a company whose specific aim was to design, make, and sell disk and tape drives that would "plug into" System/360 and therefore compete with products that IBM offered...as the designs of computers changed, the industry began to change in structure as well: it began to evolve into its present form—a highly dispersed modular cluster of firms.¹⁶

During the same period a second great innovation was happening up the road in Palo Alto at the offices of the Hewlett Packard Company. Engineers at HP established a new type of business culture based on small teams of engineers working on projects, with the firm a loosely coupled collection of departments. The ethos of HP was collaborative and open, in contrast to the command and control that characterized traditional firms. HP was housed on land leased from Stanford University, and, like the university, it had a

¹⁵ BALDWIN & CLARK, op. cit. (195-217).

¹⁶ BALDWIN & CLARK, *ibid.* (212-213).

relatively permeable boundary, with people and ideas flowing in, contributing for awhile, and flowing back out. This approach to human resources refined an open, bottom-up style of project formation and aggregation that was in turn reflected in other early Silicon Valley companies.¹⁷ Hewlett-Packard was known as the “mother” of Silicon Valley for nurturing of managers with the personal drive and flexibility to lead the modular, loosely coupled businesses that were the counterpart of IBM’s modular style of technical architecture.

B. Apple evangelizes a vision

A next great moment came in the late 1970s, about ten years later, with the birth of the personal computer. The Apple personal computer combined technical modularity and a loosely-coupled project management style. Steve Wozniak and other founding managers mostly had been trained at Hewlett-Packard. They adopted a modular architecture inspired not only by IBM but by subsequent developments in modularity in early electronic components. However, the Apple founders added a new element: fun. They had an evangelistic—some would say messianic—vision and fervor to inspire others outside the firm to join in¹⁸.

Founders of technology firms usually have vision and are excited by the future they hope to invent. The best can communicate their vision to others. The very best get customers excited: fired-up to make the future happen. The genius of Apple founder,

¹⁷ DAVID PACKARD, *THE HP WAY : HOW BILL HEWLETT AND I BUILT OUR COMPANY* (1996).

¹⁸ PAUL FREIBERGER & MICHAEL SWAINE, *FIRE IN THE VALLEY: THE MAKING OF THE PERSONAL COMPUTER* (1999).

Steve Jobs, is not in putting together hardware and software, it is in envisioning new and compelling experiences based on technology. Steve Jobs is the inventor of the personal computer. He did not invent the small computer. His invention was not “computer” but “personal.” His contribution is seen in his early marketing slogan, “A personal computer is like a bicycle for the mind.” A bicycle—an integration of the wheel, handle bars for balance, and gears—enables a person to be 15 times as effective at covering ground by his own power, as compared to walking. A personal computer does that for a person’s thinking.

Marketing and visionary ideas are what attracts contributors, including customers, to a new business ecosystem. Entrepreneurial leaders declare a new “space” for invention and investment, and provide a broad template to which members of the community can identify potential contributions and step forward to join the community. The old parable of stone soup is relevant: A village cannot find a way to work together. A mysterious stranger arrives in town, and claims to be able to make soup from a stone. A stone is found, a vast kettle filled with water, and a fire stoked beneath it. The stranger tells the onlookers, “this will be terrific soup, but it could use a carrot.” A villager runs off and returns with a carrot. The stranger now suggests that perhaps a bit of meat might add something to the soup...and so on and so on. An idea like “personal computer” is technology’s “stone soup” and a visionary like Steve Jobs, a mysterious stranger. A business ecosystem forms around visions and ideas, volunteering and sharing, trading and transacting--and a new, co-evolving economic community becomes established.

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C. Sun and AT&T promote an open alternative to an oligopoly

Ten years later, in the late 1980s, came a next advance: the first use of business ecosystems principles to compete with oligopoly ecosystems by promoting a more “open” ecological alternative. IBM, Digital Equipment Corporation, and Hewlett-Packard controlled most of the enterprise computer market at the time. A part of their competitive advantage was that each used software operating systems that were proprietary to their machines. New entrants faced a daunting hurdle of convincing buyers to bet on unknown hardware firms and on unknown software operating systems.

In order to compete in this environment, AT&T and Sun Microsystems joined forces to promote inter-operable hardware based on the Unix software operating system. Unix originally had been developed by AT&T’s Bell Laboratories, and had been licensed widely to universities. Sun had used a version of Unix, licensed from the University of California at Berkeley, for its first machines. The Sun and AT&T plan was to create a new, more powerful version of Unix, and to create a community of smaller companies, including personal computer maker Dell, that would offer interchangeable hardware. Even if customers were cautious about going with new suppliers, they might find it acceptable to go with a proven, even if academic-flavored, operating system and several alternative hardware providers.¹⁹ Sun and AT&T called the initiative “the open systems movement.” As Bill Joy, master computer architect and co-founder of Sun put it at the time, the idea was for AT&T and Sun to “change the game” and “rather than try to win

¹⁹ MARK HALL & JOHN BARRY, SUNBURST: THE ASCENT OF SUN MICROSYSTEMS (1990)

the game as currently designed, to change the game to one that [AT&T and Sun] could win.”²⁰

The result was quite interesting, and only partially as Joy and others had intended. AT&T and Sun changed the game by convincing customers of the value of open systems and of Unix. IBM, DEC and HP were forced by their customers to offer an “open” alternative. They licensed a version of Unix from the University of Pennsylvania, founded an alternative open standards organization, and matched AT&T and Sun on open features and prices. The result was that they retained much of their market share, but customer prices and computer company margins crashed. Thus their pricing power was broken, even if their share was not substantially diminished. Sun grew well from a small base, but never became a powerhouse equal to the others. AT&T did poorly overall. The game was indeed changed, but not to one that Sun and AT&T could win.²¹

D. Compaq and IBM attempt to block innovation by fellow ecosystem member Intel

Ecosystem leadership is seldom uncontested in situations I have studied. Intra-ecosystem struggles are manifold as companies seek to ensure that their particular contributions remain highly valued as the overall vision of the ecosystem advances. Business ecosystems may be understood in part through Venn diagrams and set theory. Essentially, each player in an ecosystem has a strategic theory, a mental map of how the ecosystem operates and how it should co-evolve. A player’s theory of the ecosystem

²⁰ Author’s personal conversations (1989)

²¹ MOORE (1996) *ibid.* (36-37)

might be thought of as a set of other members that lists them and describes their present and future roles. Visualize a landscape of contributors, with various groups encircled in interpenetrating Venn diagrams representing the many such sets. When the set definitions of the major participants are highly overlapping, the ecosystem is coherent. When set definitions are in conflict, the ecosystem is discordant and incoherent.

For example, in the early 1990s Intel led a campaign to upgrade the multimedia uses and the architecture of the personal computer.²² Compaq and IBM resisted this definition, and tried to slow innovation across the ecosystem and marginalize Intel's contribution. Compaq and IBM were at the time the most influential makers of personal computers. They took actions to unhook themselves from Intel's leading microprocessors, which were expensive, and to buy previous generation processors from Intel. Their rationale was that the customer would be satisfied with slower processors, and the total cost of the computer would be lower.

Compaq and IBM sold mostly through networks of resellers and computer stores, which together constituted a powerful distribution system. The two computer companies sought to convince distributors that slowing down the microprocessor upgrade rate would provide a better future for the distributors because it would also lower their costs. Essentially, Compaq and IBM sought to block Intel's innovation trajectory by refocusing the ecosystem on cost-reduction and teaching the customer to be satisfied with lower processing performance.

²² MOORE (1996) op. cit. (275)

Intel in turn allied itself with a number of smaller companies, helping them gain the expertise to make exceedingly fast and powerful computers, incorporating Intel's newest microprocessors. These firms sold by mail order and were able to go around the distributors and reach end-users directly. In addition, the personal computer magazines became supporters of the new entrants and helped them get notice in the marketplace. The mail order firms advertised heavily in these magazines, and the magazines thrived on reviewing the latest technologies and comparing vendors. The result was public embarrassment to Compaq and IBM as industry performance leadership shifted to small, previously-unheard-of companies like South Dakota-based Gateway 2000 (now Gateway).

E. IBM and HP make common purpose with a community of volunteers

Volunteerism is part of every business ecosystem, but, that said, some use it much more than others. The most striking current example of the strategic use of volunteerism is in the Open Source, Open Software movement based on the peer production of intellectual goods, and centering in the Linux operating system and the Apache web server.

There are really two major points to be made about the movement. First, the business ecosystem is built explicitly on volunteers. In that sense, it is like a political campaign. This business ecosystem is constructed to put in place a network of niches in which the contributions of literally millions of people can be coordinated.

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Second, IBM, HP and other corporations with extensive conventional financial resources and business-ecosystems competence are subsidizing and in a variety of ways helping these voluntary communities. Here is the story from BusinessWeek Winter, 2005:

Little understood by the outside world, the community of Linux programmers has evolved in recent years into something much more mature, organized, and efficient. Put bluntly, Linux has turned pro. Torvalds now has a team of lieutenants, nearly all of them employed by tech companies, that oversees development of top-priority projects. Tech giants such as IBM ([IBM](#)), Hewlett-Packard ([HPQ](#)), and Intel ([INTC](#)) are clustered around the Finn, contributing technology, marketing muscle, and thousands of professional programmers. IBM alone has 600 programmers dedicated to Linux, up from two in 1999. There's even a board of directors that helps set the priorities for Linux development. Why are they doing this? To lower their costs of goods, as well as to commoditize and to some extent destabilize commercial software rivals, especially Microsoft and Oracle.

The story continues:

... IBM, HP, and others capitalize on the ability to sell machines without any upfront charge for an operating-system license, which can range up to several thousand dollars for some versions of Windows and Unix. At HP, sales of servers that run the Linux operating system hit nearly \$3 billion during the past fiscal year, almost double the tally three years ago.²³

These companies have learned how to selectively enhance a pre-existing, volunteer-centered peer-production community and fuse its capabilities into their own grander and much more commercial business ecosystems.

F. Web 2.0 emerges

²³ Linux Inc., BUSINESSWEEK, January 23, 2005

Modularity and open interfaces continue to advance, to the point that the leading ecosystem in technology today has no overall plan or design, but rather is emerging as independent inventors and entrepreneurs introduce Internet services, and others connect them together to do something that the connector thinks is interesting or valuable. Currently, the biggest movement in the technology world is called “Web 2.0.” Call it ultimate modularity: software developers discovered that if they adopted as a universal, service-to-service interface the simplest standards on the web, they would be free to mix and “mash up” complicated solutions using piece parts sourced from each other, with very little coordination required.

Using little more than the standard web addressing protocol (the URL) plus a simple data sharing format (called RSS), Web 2.0 companies provide services that run on the open Internet and that provide essential functions for solving problems (such as search, storage/archive, security, pooling of information, notification of changes, identification of relationships, semantic analysis of content). What is revolutionary is that these services are available as public or near-public global resources with enormous economies of scale and scope, and can be joined together and/or customized by users to provide remarkably effective solutions to sophisticated problems.²⁴

Because of independent advances in underlying software and hardware, many of these services are provided by small, two or three person, “one server” operations, and yet they are becoming established services with hundreds of thousands to millions of

²⁴ See for example, Mark Benioff: Beyond Software as Service, BUSINESSWEEK online extra, September 19, 2005; INTERVIEW OF JIM MOORE OF RSSI, THE RSS BLOG (2005), available online at <http://www.kbcafe.com/rss/?guid=20051205064859>; DAVE WINER, THE COMMUNITY DIRECTORY, July 14, 2005, available online at <http://www.podcatch.com/2005/07/14>.

users. With such low barriers to entry and global reach, new services are popping up and announcing themselves every day.

These open services and their obvious success is forcing the large e-commerce and search/portal/media companies to open up their interfaces more and more deeply to enable users to access core functions in similarly simple and open ways: Yahoo!, Google, MSN, eBay, Amazon are all affected.

Media companies such as the New York Times are adding so many open services, especially in the form of RSS feeds, with so many specific topics and sources, that they are becoming real time scriptable content sources available to anyone anywhere in the world using inexpensive news aggregator software.

Users are being presented with an expanding array of powerful, general purpose, scriptable and user-oriented services from which to choose in rewiring our world. All the vertical industries will be affected. Consider SAP, the largest provider of enterprise resource planning and management system. While SAP has recently promised to make open interfaces to the modular elements of its software; this is too little and too late.²⁵ Entrepreneurs have already begun to analyze the underlying functions of SAP systems, and design open web service alternatives. Their goal is to enable corporate users to lash together powerful new capabilities at a fraction of today's cost, and with more speed and flexibility.

²⁵ NETWEAVER GETS BI , WEB SERVICES BOOST, SearchSAP.com, (October, 6, 2004) available online at http://searchsap.techtarget.com/originalContent/0,289142,sid21_gci1012523,00.html

G. Companies use the judicial system to undermine opposing ecosystems and leaders

Historically, business ecosystems originate from the unbundling and disaggregation of a departmental hierarchy in a firm, rather than the bundling together of previously independent contributions in a marketplace. The unbundling can be by literal breaking open of departments, allowing independent organizations to provide alternatives to a company's offerings, or it can be by replicating a complex production process with an open, multi-firm approach. The IBM/360 story is that of the breaking apart of IBM as an organization, and its partial replacement with IBM as the center of an ecosystem. The Web 2.0 generation of the Internet is based on the creation of an open alternative to closed web services frameworks such as Microsoft's .NET and Sun's J2EE.

The fundamental public good offered by business ecosystems is taking a challenge that requires coordination and finding a way to take it out of a firm and bring in more participants. The business ecosystem organizational form solves the problem of how to open up and extend a framework of modularity and participation. The techniques of firm-to-firm coordination used in an ecosystem, for example cross-subsidization of research and development, are mechanisms that would be considered loose and light in a conventional firm.

One of my particular concerns about antitrust law today is that some analysts look at ecosystems primarily as markets that have become collusive, rather than hierarchies that have been opened up. Given this framing of the situation, the remedies can include rigid, imposed independence at particular interfaces within an ecosystem, and a resulting

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breakdown in co-evolutionary exchanges necessary for innovation. The unhappy result is the imposition of profound social costs attendant to slowed innovation. Unfortunately these costs are hidden because they result from a future denied, rather from a present destroyed.

The invisibility of these costs is a direct result of a system driven by the interaction of plaintiffs and defendants. As computer entrepreneur and philanthropist Mitch Kapor has said, in antitrust proceedings, there are many voices for dying, threatened companies, but “who speaks for the companies not yet born?” Who speaks for technological advances? Who speaks for new forms of modularity and co-evolution? Who represents as-yet-to-be established companies and new business ecosystem structures?

We have experienced this problem in the traditional telecommunication sector. Arbitrary, legally imposed modularity has included direct prohibitions of inter-firm communication and collaboration. For example, the boundaries between local and long-distance telephone service are arbitrary from a technological and economic perspective in digital networks.²⁶ Imposition of a boundary has moved telephony innovation to the local side, where companies have direct access to customers and adjacent technologies, and has pushed the long distance companies into irrelevance.

A problem with antitrust policy that proceeds from cases is that the first plaintiffs to focus attention on a new reality try to paint the behavior that they object to as wholly detrimental to the public. Recent high profile complaints in the high technology sector

²⁶ Trevor R. Roycroft, *The Telecom Act: law of unintended consequences?* *Public Utilities Fortnightly* (February 1, 2000). Vol: 138, 3.

tend to focus on single, narrowly defined markets—such as Internet browsers or server software or microprocessors or enterprise databases. Plaintiffs focus on particular market interactions, and try to prove manipulation and collusion. Yet, in many cases, the aggrieved parties are not so much concerned about the interaction argued before the court as they are intent on breaking into an opposing ecosystem and/or breaking down its coordination by attacking its mechanism of collaboration.

The long running legal attacks on Microsoft have been an unfortunate mix of legitimate concerns and illegitimate attacks veiled in the rhetoric of competition policy. Actions that Microsoft took to coordinate contributions across the ecosystem were painted as discriminatory and collusive, and were compared implicitly with arms-length market transactions. Seldom was there formal consideration of the countervailing public goods arising from the coordination and co-evolution that was supported by Microsoft's leadership in the ecosystem. Indeed, the existence and value of the ecosystem organizational form was apparently invisible to the court.

While there were merits on all sides of the case, the consideration was almost laughable when viewed from the business ecosystems point of view. Stunningly missing was an appreciation that at stake was a contest for ecosystem leadership, not between Microsoft and Netscape, but between the Microsoft-Intel-personal computer vendor ecosystem on the one hand, and an alliance of Sun Microsystems, IBM, and Novell on the other. The case itself was one of many ecosystem-disrupting initiatives unleashed over the years by these ecological protagonists.

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For outsiders, perhaps the best way to understand these issues is through journalists' accounts of the work of attorney Gary L. Reback.²⁷ To those within the technology sector, he is a key point-person for the campaign against Microsoft's ecosystem leadership, targeting important elements of the ecosystem and seeking to paint as collusive evidence of co-evolutionary actions. This campaign has included lobbying the Department of Justice, the Federal Trade Commission, and members of congress. A concerted effort has been made to portray Microsoft as a force of evil, and unfortunately the ecosystem form has been tarred along the way.

Many of today's public policy fights are extensions of the same campaign. For example the fight in Massachusetts to have the state government mandate the use of the "OpenDocument" format for office software is a direct struggle between IBM, Sun and Oracle on one side, and Microsoft on the other. In late December of 2005 the major proponent of the OpenDocument initiative in Massachusetts, state CIO Peter Quinn, resigned saying,

²⁷ Summaries of Reback's work include James Daly, *The Robin Hood of the Rich*, WIRED MAGAZINE, Vol. 5, 8, August, 1996, available online at <http://www.wired.com/wired/archive/5.08/reback.html>; Margie Wylie & Nick Wingfield, *Microsoft Menace*, NEWS.COM, September 5, 1996, available online at http://news.com.com/Microsoft+Menace/2009-1082_3-233589.html; Paul Solman, PBS NEWSHOUR WINDOWS ON THE WORLD, March 3, 1998, available online at http://www.pbs.org/newshour/bb/business/jan-june98/microsoft_3-3.html; John Heilemann, *The Truth, The Whole Truth, and Nothing But The Truth*, WIRED MAGAZINE, Vol 8,11, November 2000 available online at http://www.wired.com/wired/archive/8.11/microsoft_pr.html; JOHN HEILEMANN, PRIDE BEFORE THE FALL (2000).

I have become a lightning rod with regard to any IT initiative. Even the smallest initiatives are being mitigated or stopped by some of the most unlikely and often uninformed parties. The last thing I can let happen is my presence be the major contributing factor in marginalizing the good work of ITD and the entire IT community.

While the struggle is draped in high minded talk of open systems and standards—and does address some of these matters—it is at root a street-level competitive fist-fight carried into a political venue.²⁸

From a defendant's point of view, it has been very difficult to bring forward a defense based on the role of co-evolutionary mechanisms in business ecosystems, given that business ecosystems themselves have not been clearly established in policy and law. Whether in cases such as the United States versus Microsoft, or policy conflicts like that which embroiled the Massachusetts OpenDocuments initiative, it would be helpful for all parties involved to have a shared, on-the-table understanding of what exactly is at stake when members of rival ecosystems stand off against each other. To date that has not been the case.

H. The ecosystem organizational form becomes widely adopted

My hope is that the previous section went some of the way in demonstrating the prevalence and power of the ecosystem form. Business ecosystem strategy-making and economic organization is no longer limited to the high technology computer and communications technology sector of the economy. The concept has now spread far

²⁸ See for example, Elizabeth Millard, *Political Animal: Massachusetts IT Office on the OpenDoc Defensive*, EWEEK.COM, November 1, 2005, available at <http://www.eweek.com/article2/0.1895.1880329.00.asp>; On the resignation of state CIO Peter Quinn, see Matt Mondok, *Massachusetts' biggest OpenDocument supporter hangs up his pompoms*, M-DOLLAR, December 30, 2005, available at <http://arstechnica.com/journals/microsoft.ars/2005/12/30/2253>.

beyond its origins in high technology, and is central to organizing innovation across the full spectrum of industries, from fashion and retail, to energy and oil production.

To some extent, this has happened as companies looked to high technology for ideas, and as information technology companies have evangelized the business ecosystems concepts to their enterprise clients. Consider that in 2004 about 60% of business capital investment in the United States was for information and communication technology²⁹. The percentage is smaller in other nations, and in developing countries, but in all cases such technology is a central part of business investment today. Information and communication technology holds the mind of the firm. For years now, the business ecosystems approach has been consistently championed by leading information and communications companies when working with their customers.³⁰ As their products and services have become the essential infrastructure for the world economy, the business ecosystems ideas have been carried deep into the organization designs of their clients.

These observations understate the case. The concept has spread for one fundamental reason: the primacy of innovation in a global economy. Most businesses today must shape the co-evolution of innovation across a multitude of complementary contributors, sometimes numbering in the thousands, strewn across the entire world. These are business ecosystems. These complex adaptive multi-contributor systems must be overseen and led. This is the core challenge for today's businesses.

²⁹ *Gross Domestic Product and Corporate Profits*, BUREAU OF ECONOMIC ANALYSIS, UNITED STATES DEPARTMENT OF COMMERCE, December 21, 2005

³⁰ For example, see *Growing Beyond Your Industry: Business Ecosystems are redefining your competition*, IBM Corporation, online at http://www-306.ibm.com/e-business/ondemand/us/innovation/ecosystems/bizecosystems_flat.shtml

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III. Business ecosystems as public goods

An assessment of the antitrust issues regarding business ecosystems recognizes their positive contributions to society as a whole, as well as to business. Without insight into the social potential of business ecosystems, we run the risk of attempting to cripple or ban them in a mistaken effort to improve the markets and firms they encompass and supersede, simply because we do not recognize the ecosystem form for what it is.

In the following sections, I will discuss four intangible and four tangible public goods created by the ecosystem form. Intangible public goods include ideas that can be used to galvanize constructive collective action among a diverse group of participants. Ideas like “market” and “firm” have this effect, and are well-recognized today.

The business ecosystem organizational form is enabled by four related ideas:

First, there is the concept of the business ecosystem itself: a collaboration to create a system of complementary capabilities and companies. In the middle of the 20th century, the concept of the multi-divisional firm was a great advance, because it enabled managers to see opportunities for its application, and to make plans and take action. Similarly, an understanding of the business ecosystem concept accelerates its application and is thus an important and expanding public good.

Second, there is the concept of a “space” for business opportunity. “Space”—also talked about as “white space,” “market space” or “opportunity space”—is the concept of a future domain of business activity that may not exist today, or that exists only in nascent form. A concept of an attractive space can be taken to venture capitalists, to

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leaders of corporate business development groups, or to bands of entrepreneurs and respectfully considered. If the story is compelling, a business can be financed to address a space. This is an important enabling concept for a society that hopes to be innovative and attract entrepreneurial interest in its biggest challenges.

The concept of a specific business ecosystem naturally follows from the concept of a space. An ecosystem is a cooperative approach to developing businesses within a space. Within a particular space there will be a number of critical contributions that need to be linked in order for solutions to be produced. To describe a specific proposed ecosystem, managers must identify these critical contributions, make preliminary distinctions about modularization, and in turn define initial niche contributions and contributors.

Fourth is the concept of a company as principally defined by its innovation trajectory rather than by its current products, services, and tangible assets. Seen from an evolutionary perspective, every occupant of a niche is under constant challenge to keep up with others in the ecosystem. In biology, a species is always evolving to stay ahead of predators, competitors, and a variety of parasites and diseases. Sexual reproduction is nature's way of enabling species to roll the genetic dice by mixing DNA from two parents, in order to on occasion come up with an unexpected combination that jumps them ahead of their co-evolutionary rivals. Similarly, companies in a business ecosystem are under constant threat of competition and commoditization. The only way they can sustain themselves is by aggressively improving their contributions. The concept of a company as an aggressive continuous innovator is a far cry from the traditional concept

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of the firm, where scale and operating efficiency is essential, and improvement nice to have.

These four intangible public goods are joined by four that are more concrete: campaigns, infrastructure, customer feedback, and financing. To turn an ecosystem idea into reality, the contributors must take initiative and join together to make it happen. Initiatives may be bundled together into continuous campaigns for ecological advances. These campaigns are public goods in that they can be joined by others, and they help shape the future and move society forward in particular directions.

As an ecosystem becomes real, its combined base of technologies, designs and contracts, products and services becomes an infrastructure within which new contributors and customers can be added. New offers can be added at modest incremental cost. For example, there is a new computer company in the market called “Alienware,” that sells to young gamers. Its computers combine very fast graphics capabilities with strange, futuristic cases made in organic shapes molded from garishly colored plastic. This new company uses the existing ecosystem as a readily available platform from which to launch its offers. It draws on readily available components packaged in manner that is compelling to its customers.

If the entire juggernaut of a business ecosystem is to stay relevant, it must incorporate customer feedback. In some of the most open ecosystems, customers can switch out modules and suppliers at will, and thus affect not only the vision of the ecosystem but its industry structure. Thus a new public good is established whereby customers are put increasingly in direct control of the goods and services they consume,

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the processes used to make them, and the innovation trajectories to which their own lives are joined.

Finally, the ecosystem must be financed, and, over the past decade, new institutions and instruments have been invented to serve those who want to establish business ecosystems. This in turn has made it possible to tackle problems of increasing size and complexity with the ecosystem organizational form.

A. The concept of the business ecosystem

An economy is created when people recognize that there are things that they can accomplish together which they cannot accomplish alone. An entrepreneur is by definition someone who seeks a goal beyond his or her current reach. The initial public good provided by the business ecosystem organizational form is to communicate to a collection of entrepreneurs the potential of collective action. Like the idea of democracy galvanizing a society, the idea of a business ecosystem provides a vision and proof of concept that multiple contributors with differing interests can join in common cause.

This public good, like its counterpart “democracy,” is intangible. It is an ideal that exists in the mind of its possessors. Like shared language and the concept of democracy, the business ecosystem concept shared in the minds of hundreds of entrepreneurs is a powerful aligning force, reducing, if you will, the transaction costs of achieving cooperation and collective action.

The ideal business ecosystem has leaders who co-envision and co-manage co-evolution among members. These leaders establish what might be called “polity” or

community governance. The ideal business ecosystem achieves “collective action” in a manner similar to democratic and quasi-democratic communities, and members find ways to rally around valuable and exciting futures. The members of a successful business ecosystem co-create their future.

Members of an ideal business ecosystem are motivated to work together to advantage the community. Their focus is on working with others to develop and expand existing and new markets in which both their present capabilities as well as future contributions may have full play. In the computer business, for example, the rallying cry has long been to “grow the TAM”—that is, the Total Available Market—by finding new uses for the core technology and new complementary products and services that will bring these potential uses to life for customers.

B. The concept of a “space” of opportunity

In corporate usage today executives tend to speak of “spaces”—as in the “enterprise Web 2.0 space”—and this term is roughly equivalent to landscape or terrain in biology. A new space in this sense exists in the minds of entrepreneurs, and not in any physical place. In business ecosystems strategy, by definition, a space is seen as comparatively unbounded, open, with limits that are unexplored and will only be defined by the establishment of business ecosystems within them. Hewlet-Packard’s motto of “attack the undefended hill, not the defended one” is a classic statement of this view. Find a new hill or space—often called “white space”—and find new problems to solve, new solutions to invent.

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The declaration of a “hot” space is a rallying cry that seeks to draw the attention of hundreds or thousands or millions of entrepreneurs toward solving a set of related problems. However, a space is not yet an ecosystem, it is a call to come together to form an ecosystem. Convergence on a space may set off a land rush, but it is not yet farms and fields, gold mines and cattle ranches. The concept of a space does not define elements of the solution, nor their combination and interaction. That is the task of our next public good, the definition of a business ecosystem.

C. A shared definition of a business ecosystem

A shared definition of a business ecosystem is a key public good that, like the idea of the business ecosystem and the identification of a space, is both intangible and effective in aligning action among entrepreneurs. A business ecosystem definition is at its core a plan for how the contributions in the proposed system will be modularized, and what sort of firms will provide which element. Ecosystems strategists often talk in terms of “solution stacks” that are envisioned as modular contributions building one upon the other, interacting through defined protocols at the interfaces. An illustrative solution stack could consist of a microprocessor, operating system software, an application, and a group of trained users addressing a medical problem that requires a computational solution. To a large extent, modularity determines industrial structure, as once a module and interface is defined and established, the work “behind the interface” can be accomplished by a discrete firm. Thus, increases in modularity—or perhaps better said,

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increased technical granularity—tends to lead to an increase in the number and types of firms engaged in the ecosystem.

Obviously not all definitions of a business ecosystem are going to be equally desirable to potential members. Not all ways to colonize a space feature the same technologies and providers. Thus a given “space” might have only one favored ecosystem definition, or it might have several vying against each other. So-called “standards battles,” such as VHS versus Betamax, are usually indications of competing ecosystem visions.

So-called “open standards” are attempts, often driven by powerful customers, to establish ecosystem definitions that put large players on an equal footing, and thus promote competition and choice in key roles. Of course, as companies have become sophisticated at ecological strategy making, one common practice has been for a dominant firm in one role to subsidize open standards efforts adjacent to a second dominant firm in a different role, in order to undermine profitability and promote choice in a part of the ecosystem remote from its own strongholds.

IBM has been a leader of such activities, defining the nature of and making open and competitive whole ecological zones encompassing many niches, and establishing itself as a provider of systems integration and consulting services drawing on the fruits of open technological ecosystems. The combined result is that many vital roles within enterprise software ecosystems now have open interfaces and are commoditized and/or highly contested.

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One of the challenges for students of the business ecosystem perspective is that ecosystem definition is in large measure a forward looking vision maintained by industry leaders, rather than a post hoc result of industry practice. Essentially, the concept encourages companies to explore outside their natural boundaries, whether of firm, industry, or economic sector, and seek ways in which their institutional context can be reshaped to their and their allies' advantage.

The companies in a business ecosystem tend to have differing images and understandings of the ecosystem, even in a highly aligned situation. For example, Intel and Microsoft share in what many call the "Win-tel" ecosystem. They have profoundly overlapping interests. On the other hand, they constantly struggle over elements of the vision that each deems critical, and on which they have divergent perceived interests. Thus a business ecosystem has a politics not unlike a political party. A party is able to act coherently as long as its members have largely overlapping views. Complete identity of perspective within a political party or among the leaders of a business ecosystem is not possible, nor is it desirable. To achieve such would be to reduce the total diversity of ideas, and cripple the very innovation the ecosystem is intended to promote.

Sometimes it is clear to observers that some form of business ecosystem is desirable within a given space, but leaders are not able to pull together sufficient political capital to create a workably cooperative ecosystem. In these cases, it is sometimes an effective technique for a single firm to temporarily internalize the business ecosystem, establish it, and then gradually open it up to increasing numbers and types of participants. For example, it has been apparent for some time that an ecosystem for legal downloading

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of music could be successful and meet an important need. The contribution of Steve Jobs with iTunes and the iPod family of products was to design elements of a solution that worked for key potential stakeholders, ranging from users to music companies. He accomplished this by launching an almost completely enclosed ecosystem, like a biodome, where his company, Apple, underwrote, purchased, integrated and operated the core contributions. Once the vision and the value of the solution took off in the market, Jobs has encouraged the expansion of the ecosystem by pulling in recordings by independent artists, podcasts, and ebooks, by encouraging third party add-on hardware, and by co-marketing with computer companies such as Hewlett-Packard. However, he has been careful not to open up his digital rights management system, and thus has prevented non-Apple music players from being used within the iTunes ecosystem.

D. Continuous innovation as an expectation of all members

High standards may themselves be a public good. The business ecosystem sets high standards for continuous improvement. The ideal business ecosystem is an economic community of highly flexible producers and consumers, who specialize in order to innovate. The ideal members recognize that their own value comes from constant improvement in their particular road map or trajectory of progress. Sometimes this is called an innovation “treadmill” to stress the difficulty of continuous advance. This dedication to planned change, shared among hundreds of members, gives the business ecosystem its astounding power to generate new overall contributions to society.

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Given that companies are willing to dedicate themselves to innovation, membership in a business ecosystem shields them from three expensive problems. First, because they can integrate with others through relatively simple, stable interfaces, they can focus on managing interdependencies and complexity within their particular domains, and to some extent ignore the details of struggles and progress in others.

Second, to the extent that there are several potential ways in which individual contributors could hypothetically package or otherwise structure their own innovative contributions, they are able to work out collaboratively with others in the ecosystem a reasonable way to proceed. Thus instead of having to develop along multiple paths, and/or make big bets on highly uncertain futures, they can gain reciprocal commitments from other members of the ecosystem and thus focus their efforts on a narrower set of outcomes. The resources that would be absorbed managing interdependencies and uncertainties in a less coordinated system are available, if desired, to be invested instead in ever more rapid core innovation.

Third, members of a business ecosystem share the costs of stewardship of the ecological community as a whole. Market creation is expensive. The mainstream personal computer market was established in large part through IBM's multimillion dollar ad campaign featuring "the little tramp," combined with a roll-out of hundreds of IBM computer stores where customers could try the new machines. None of the other members of the ecosystem could have afforded that expenditure, and companies like Microsoft and Intel as well as a thousand smaller companies all benefited. As the personal computer market expanded, trade shows like Comdex became important

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gatherings that enabled members of the ecosystem to see each others' coming wares, find allies, and dialogue with leaders of other companies in order to maintain a changing but shared vision of the future all would help to create.

E. Permanent campaigns of ecosystem leadership

A sustainable social movement is a public good. Social movements coordinate individual efforts and make them more effective, and if the movement is inclusive it will provide a home for an ever increasing and ever diversifying membership. The public good of a campaign to sustain a business ecosystem is momentum. Momentum is the idea in the mind of a constituency that progress is not only possible, but it is happening. Momentum encourages hope, dreaming, and commitment.

A vision of a business ecosystem is not maintained in practice simply by being beautiful and compelling. Cooperation is difficult in practice. Competition that leads to fragmentation is a constant threat to a business ecosystem. Firms are distracted away from community concerns by the immediate, pressing work of running their own innovative businesses. Thus the only way that co-evolution can be achieved is through campaigns to keep a shared vision alive. These campaigns are often underwritten by large companies, but are sometimes the result of visionary politicking by small companies, groups, and charismatic individuals.

In practice, firms tend to use the term "business ecosystem" to describe in broad measure contributions that they see as essential to the success of whatever particular innovation—technology, product and service, consumer vision—they are promoting. As

much as anything, the term is used to invite others within and beyond a firm to come together to make a new market. The breadth of the term tends to be established in every case by an only partly explicit process of identifying key complementary contributions and contributors, reaching out to them to try to establish collective action, and extending the ring of recruitment as far as can be, limited by the firm's ability to pay for such outreach, the resistance or cooperation the firm achieves by others who might be constructively involved, and the ability and willingness of others to contribute services and/or to help fund the collective outreach.

Again, these efforts are akin to political campaigns in that they seek to achieve collective action by other freely acting agents. Part of the creativity of campaigns is identifying non-obvious but potentially important contributors and reaching out to them, and identifying non-obvious but potentially important contributions and incorporating them. Intel, for example, was concerned in the early 1990s that its ability to deliver processing power would outstrip the customers' needs, given that it was doubling processing power per chip every 18 months. The company decided that increased use of graphics, audio, and video was an answer to its concern, because these require large quantities of processing power. Intel set out to convince the other members of the personal computer ecosystem of the advantages of what it called "multimedia personal computers." This campaign engaged graphics chip vendors, printer makers, display companies, and software companies at both the operating system and the application levels.

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F. A network of niches

Once established in concrete, tangible reality, the business ecosystem as a public good is like the infrastructure of a city. Roads, electricity, telecommunications, as well as the fabric of laws, enforcement, and culture are what make a modern city able to bring together a diversity of citizens. At its core, a business ecosystem works like this: A network of niches of complementary contributions is established. Each of these contributions can be improved somewhat independently. The hardware can be made to go faster, the software web server can be made to handle higher numbers of simultaneous users, and new features can make the application more valuable to users. The good to society that this modular design provides is that it enables distributed parallel innovation that can be integrated into a whole, an observed benefit of modularity from the time of the IBM/360 architecture forward. Moreover, if the interfaces are open, other members of society can become involved, and the influence and reach of the ecosystem expands.

In a business ecosystem there are ideally many potential providers for any one contribution or niche. They stimulate each other by largely market mechanisms to provide low-cost, high performance components today, while they race against each other to invent tomorrow's advances. The advantage for the public is that this model provides for low prices, through market-oriented competition, as well as co-invention and continuously improved performance.

The ties that bind members of a business ecosystem revolve around the contracts that govern short-term exchanges among the parties. These include contracts for goods and services. Thus Microsoft, for example, charges computer companies for the

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inclusion of its operating system on machines sold to customers. It may also, as has been the target of court action, attempt to obligate its customers to include only its operating system, and to exclude alternatives such as Linux.

The infrastructure of business ecosystems, the nature of modules, the particular technology choices that are embedded in the modular design, and the openness or proprietary nature of the interfaces between modules has a great deal to do with who participates and how. In the development of the IBM/360, the interfaces between the modules were at first not perfected and were not fully documented. It took several years for the interfaces to become clear, well-documented, and stable. It was not until this was accomplished that the ecosystem interfaces became open enough for engineers to decide to leave IBM to establish competing modules and businesses.

Ecosystem-leading companies have since learned that perfect modularity is not always to be desired, particularly if a given company hopes to play a dominant role in both sides of an interface. Application software companies have long accused operating systems companies of maintaining undocumented interactions between operating systems and applications, in order to advantage the operating system provider's own offers.

Conversely, the wide proliferation of companies on the Internet is thought by many to be due to Tim Berners-Lee and other pioneers who rightly set up the basic interfaces of the network in a simple, stable, and largely democratically controlled fashion. Similarly, the current revolution in web services depends upon a data sharing standard called "RSS." David Winer, the main developer of RSS, has invested years in

fighting to keep the standard simple and open, in order to keep the barrier to entry to RSS companies low, and thus to promote widespread innovation.

G. Consumer-driven feedback

A business ecosystem gains its sustenance from consumers. It cannot turn sunlight and water into structure and biomass, as can its biological counterpart. The business ecosystem analogue for sunlight is customer interest, expressed in money paid for goods and services. Just as plants are heliophytic and turn toward the sun, members of business ecosystems follow revenues. Money comes into the business ecosystem from the environment beyond, and the ecosystem uses this money to fuel its activities, to produce outputs, and to build up its structure.

The feedback system in capitalist economic systems is directed by customers. If customers buy, they send a signal that they like what they find, at least in comparison to what else is available. If customers stop buying, they send a converse signal. This market-based customer-to-producer signaling is perhaps the most fundamental public good of capitalism.

Yet for all of its value, customer signaling is generally highly attenuated in conventional firms and markets. In most businesses, customer feedback only indirectly touches the responsible business functions. The customer complains to the retailer, who may or may not tell the distributor, who in turn has no one to talk to at the manufacturer, who today is likely to be located in China, and in turn is directed by a designer on contract to the firm named on the label. A department within a company may perform

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poorly, but even if the customer complains to the named firm directly, seldom are there good mechanisms for directing the complaint to the offending department. Long-term and at a macro scale, of course, the system works. Eventually competition replaces lagging companies and products with leaders. But the process is often slow, imprecise, and indirect.

Business ecosystems can do better. Many make their own modularity transparent to the customer. By revealing which modules perform what functions, business ecosystems can provide very direct links between customers and providers. In open business ecosystems, such as those surrounding personal computers, customers are made aware of many key components and can, at their option, make choices. Computer gamers endlessly debate the advantages of one graphics chip set over another, and express their conclusions in purchases of discrete graphics cards. Enterprise buyers trade off microprocessor benefits, sometimes selecting compatibility with current applications, and sometimes choosing to migrate to advanced chips that in turn require new software. Companies have thrived by enabling this level of choice. For example, Dell Computer is a telephone-based market maker that customers use to purchase modules from across the personal computer ecosystem; the modules are assembled by Dell and shipped to the customers.

In the most open and advanced business ecosystems, for example those created by today's Web 2.0 public web services, entrepreneurs and inventors offer modular web services with simple interfaces, and service integrators and end-user customers are free to combine these services in any manner they see fit. Many combinations and applications

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can be tried, across uses and potential markets not even describable in many cases. Surprising solutions may take off, gain customers, sometimes by the millions, and in effect define a business ecosystem and a network of contributors in real time. The public good here is enormous, as the customer him or herself is completely free to combine any and all services, and to explore any and all uses.

Imagine a world of millions of web services, with a few thousand new ones introduced every day, searched and sorted like today's web pages, and integrated by end users. This then is the promise of business ecosystems: massively distributed, open participation in collective solutions to important human problems, drawing on talent from across the entire world.

H. Financing the business ecosystem

Any enterprise must be financed. A business ecosystem presents a complex financing challenge because it contains businesses with varying internal economics, and because the funding needs of members of the ecosystem differ with the scale and maturity of the ecosystem. A chip company may need to invest billions in fabrication facilities. A web services company might consist of only a few individuals.

Consider four stages of maturity for a typical business ecosystem³¹. Imagine that these stages are analogous to the process of ecological succession in biology: Grasses and weeds stabilize a new space, are followed by conifers and nitrogen-fixing trees such as Alders, which in turn produce conditions for hardwoods, for differentiation between

³¹ MOORE, *op. cit.* (64-105)

canopy, forest, and forest floor, and finally give rise to the climax structure of a rich, diverse, and stable ecosystem with substantial biomass.

Similarly in business there are early pioneers of a new opportunity space, there are settlers who establish foundations and enable the new business ecosystem to take off, and there is the climax stage of the business ecosystem, with relatively clear modularity of technology and firms, and relatively clear relationships among contributors. Particular challenges emerge in a predictable sequence as a business ecosystem becomes established and matures. One of the most interesting observations is that ecosystems tend to be financed differently by stage. Financiers and financial institutions have become specialized to serve the needs of business ecosystems and, not surprisingly, have invented stage-specific funding approaches.

The first stage of pioneering is highly chaotic and as a practical matter would be hard for any outsider to understand, let alone try to finance. Thus funding often comes from entrepreneurs themselves, angel networks, and early stage venture capital companies. In addition, funding may come from universities, foundations, government, as well as from corporate laboratories. Finally, certain venture capital groups have become adept at identifying emerging business ecosystems and investing systematically and comprehensively to help them grow.

In the second stage, the core value and contributions of the ecosystem have become well-known, and the challenge is expanding into the potential market before others can do so, and becoming capable of supplying goods and services in the scale required. Growth capital is required that exceeds what angels and entrepreneurs can

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provide. Companies turn to institutional venture capital and private equity firms. In addition, growth at this stage is often funded by large established companies that are successful in adjacent domains, for example IBM funded the growth of the personal computer industry, going so far as to loan Intel capital for its first major chip fabrication facility, and helped Microsoft build out a professional organization that could in turn keep up with market needs. As the ecosystem and its central companies become more substantial, their capital needs continue to increase, and firms turn to public markets. At this point billions of dollars will be raised. Private investors will typically exit the ecosystem, having netted powerful capital gains if the investors put their money into firms that achieve leading roles.

In the third stage of development, a successful business ecosystem establishes a comparatively stable role structure and substantial scale. Firms blessed with contributions with strong economies of scale, such as high volume chip and software companies, can become superbly profitable if they play a unique role in the ecosystem. In terms of innovation trajectories and product road maps, this is a time when the more powerful players try to more deeply fix their own preferred technologies into the shared future of the system, and when they may try to head off or block advances delivered by players in other niches who are seen as rivals for leadership or as promoting competing core technologies as well as visions of the future of the whole ecosystem.

The most profitable companies in an ecosystem may find ways to subsidize the operations of cooperating firms that are not as profitable, or who require capital expenditures that are beyond their reach. Thus software companies will routinely provide

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money to distributors, value-added-resellers, and retailers in order to cement their allegiance. Such funds can come in the form of cooperative marketing programs, special sales incentives, and various forms of technical, sales, and service support. Large firms in an ecosystem may use corporate venture capital funds to invest in companies that provide key complementary contributions.

In the fourth stage of the business ecosystem, growth slows and obsolescence threatens. Firms focus on increasing their shares of the total profits of the ecosystem, necessarily at the expense of other members. Relative profit margins from niche-to-niche are in play. Stronger occupants try to buy up or drive out rivals within their niches, and then use their concentration to gain pricing strength against those in adjacent niches. Technology buyout firms may provide financing and strategic counsel. Traditional contests for market power, and traditional abuses of market power, now emerge in dyadic relationships between ecosystem trading partners.

I. In summary, the business ecosystem organizational form as a public good

Imagine that a group of leaders come to you with a proposition: They have a way to organize the contributions of hundreds, thousands, or perhaps millions of entrepreneurs and organizations to address a major global social problem, perhaps AIDS or malaria. Would you help them? How would you determine if they have a chance at success? What would your questions be?

Here are some of the questions I might have:

How are you going to get all those potential participants to believe that they can work together effectively and creatively? How will you motivate them?

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How will you organize them? What will be the key roles? How will you let each group innovate relatively freely, but ensure that as the project proceeds all of the contributions will come together?

Obviously many different sorts of talents will need to be involved, and no one organization can oversee and direct their work. How will you ensure that the group is open to ideas no matter where and how they originate, in order not to discriminate against some potential contributors and favor others?

And how indeed will you finance this amazing venture?

My point is that these questions are addressed by the business ecosystem organizational form. Our challenge as a society today is to promote and combine creativity in order to solve major economic and social problems. The ecosystem organizational form grapples with this challenge. The business ecosystem organizational form is an important public good in a world of fast-moving technologies, globalization and the potential inclusion of vast numbers of contributors, and complex, multi-dimensional economic and social needs.

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IV. Evaluating power and abuse in business ecosystems

While the benefits of the business ecosystem form of organization are unprecedented, the problem today is that while the form is highly visible, recognized and used in the business world, it is comparatively invisible in the law. On this issue, we face at least a gap in knowledge, and perhaps a cultural gap between the two worlds of business and law, where one has gotten far ahead of the other.

Competition policy and antitrust regulation and enforcement is based on conceptions of economic power and abuse of power. Concepts such as “market power” “leading firm,” “excessive concentration” define power in traditional markets. Abuse of power, expressed in predatory or anti-competitive tactics have been carefully and in many cases precisely and quantitatively defined. The problem that policy makers and the judicial system must now address is whether these precise terms and metrics can be applied, perhaps with some modifications, to business ecosystem organizational models, or whether new and parallel models of power and abuse are warranted.

A. Power and abuse in business ecosystems

A simplified view of antitrust theory is that businesses amass power in markets, and they can abuse it. They abuse it by overcharging customers. And they may abuse it by driving out competitors, and then overcharging customers. A parallel view of business ecosystems would be that businesses can amass power at not one but three levels: in spaces, in ecosystem leadership, and in particular niches within an ecosystem.

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Power gained in each of these levels, alone or in combination, can be used to overcharge customers and/or drive out competitors.

Antitrust pricing theory has been refined to a high science, but in general it deals with prices within markets as traditionally defined, expressed in money, and goods and services that have been paid for. The purpose of a business ecosystem is not only to deliver today's solutions, but to deliver tomorrow's innovations. Thus, the most egregious overcharges are those that deny innovation to customers.

B. Power and abuse in an ecological space

Overcharging in a space might arise from one company undermining attempts to establish substitute ecosystems based on more advanced technology and/or other forms of innovations not incorporated in its own favored ecosystem. A recent example is the attempt by traditional wire line telephone companies to block the spread of internet-based telephony. Had they succeeded, customers would have been overcharged for telephone services. Only because of consistent FCC protection for voice over the internet, and the aggressive support of computer and cable television companies have the new ecosystems been able to thrive in the telephony space. There are many subtle versions of this sort of overcharging, where incumbent companies attempt to stop so-called "disruptive technologies" maturing into established ecosystems.

C. Power and abuse in a business ecosystem

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A company can cause an established business ecosystem to overcharge for innovation by blocking the innovation trajectory and contribution of another player. This can have the effect of slowing progress across the ecosystem. This in turn may allow the offending company to temporarily slow innovation-oriented investment in its core contribution and thus increase its current profits while holding its prices constant. Companies hope to slow the innovation treadmill while holding their own and end user prices high. In the previous section, we considered the example of Compaq and IBM attempting to prevent the adoption of a next generation microprocessor, and thus reduce customer demand for their own complementary innovations as well as reducing their cost of goods to the maker of the processor, Intel. Intel then reached around these companies and found a way to bring the processor and associated technology to market, where it found ready customer demand for next generation innovation.

D. Power and abuse in a specific niche or contribution

Power within a particular niche is perhaps the easiest form to recognize. Essentially all major technology companies hold one or more such positions, Cisco in many functions of networking, Oracle in many database domains, and so forth. These positions can themselves be public goods, because they provide coordination points and standard interfaces to which complementers can design. They create rallying points for ecosystems.

These positions are remarkably profitable. Software gross margins in a core niche in an ecosystem can exceed 90%, as can margins for network-based services such as

Google's advertising services. Chip gross margins in a core niche can exceed 50%. Incumbents argue that these margins are justified, because they are only maintained by massive forward investments in research and development and new operating capacity. Last year's software and chips are almost given away. Technology companies spent multiple billions per year inventing and building next year's and the following's businesses.

That admitted, rivals will argue that incumbents spend substantial sums blocking their entry and expansion into the ecosystem. Incumbent firms do indeed invest heavily in deepening their relationships across the ecosystem. Many of the very same activities we describe as public goods in the preceding section, such as continuous campaigning, sharing research and development, and cross-subsidization can be seen as potentially exclusionary.

E. Toward a legal definition of space, ecosystem, and niche

Outright abuse of dominant within-niche positions is comparatively easy for a layman to see, because tactics tend to be addressed against specific firms within a niche or attempting to enter a niche. Tactics include direct attacks on competitors, as well as restrictive agreements with other members of the ecosystem that effectively lock out the competitor. That said, cases can be difficult to bring against a company. Without a legally-recognized concept of business ecosystem and niche, there is no straightforward way to express concentration. As we have emphasized, a company can have 100% share of a niche in an important ecosystem, and only a small share of its industry or market as

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conventionally defined. Any defendant's legal team worth its salt will make this argument.

The problem is even more difficult when it comes to defining power and abuse at the space and ecosystem levels. The phenomena are real. Companies amass power at both levels. This power can be abused. But coming to legal descriptions and definitions of these realities that can stand adversarial proceedings in court is a job that has not been done.

F. Defining behavior in business ecosystems: promoting pro-competitive openness in spaces, ecosystems, and roles

While it remains vital to do a better job of defining concentration and power in a business ecosystem, one can move forward in any case by assuming the existence of such power and addressing behavior by the powerful. The most fruitful of these is the attempt to more precisely and actionably define "openness" in business ecosystems. The argument is that if modules are properly defined and interfaces are well-documented, and business contracts are not restrictive, then the network of niches of the ecosystem can be said to be open to new entrants. If an incumbent in a leading role invests in opening the ecosystem, for example by promoting neutral standards efforts, then its ecosystem-reinforcing investments can be pro-competitive and pro-innovative.³²

³² See for example, Paulo Dini, Mary Darking, Neil Rathbone, Miguel Vidal, Pablo Hernandez, Pierfranco Ferronato, Gerard Briscoe, Stan Hendryx, *The Digital Ecosystems Research Vision, 2010 and Beyond*, SEVENTH FRAMEWORK PROGRAM OR RESEARCH , EUROPEAN COMMISSION, (2005) available at http://www.digital-ecosystems.org/events/2005.05/de_position_paper_vf.pdf/; *Technologies for Digital Ecosystems (a program for supporting business ecosystems mainly composed of small and medium enterprises)*, DIRECTORATE GENERAL INFORMATION SOCIETY AND MEDIA, EUROPEAN

Research on these matters has been driven by coalitions of powerful information technology buyers, including large corporations and government, supported by companies hoping to dislodge competitors' holds on particular positions. Progress is being made. What is urgently needed are comprehensive studies of the entire panoply of power and behavior in business ecosystems, including refining the fundamental concepts, documenting relationships between power, innovation rates, pricing and margins, and scrutinizing tactics used by firms in establishing and leading business ecosystems. As we work toward these accomplishments our goal must be to approach the sophistication with which today we address conventional markets.

As Gundlach³³ has described, the empirical and multi-disciplinary post-Chicago approach to antitrust is ascending. Members of the judicial system have experienced the limitations of a minimalist focus on markets, concentration, pricing and output. They are developing new ideas in conjunction with experts in marketing, strategy, game theory, systems thinking and other disciplines. There is renewed appreciation for grounded studies of how managers and companies act in specific situations. This broadening of antitrust methodology will reap enormous benefits, and is necessary if the field is advance along with the businesses it oversees.

COMMISSION. Available at <http://www.digital-ecosystems.org/>; Roadmap for Open ICT Ecosystems, BERKMAN CENTER FOR INTERNET & SOCIETY, HARVARD LAW SCHOOL, (2005) available online at <http://cyber.law.harvard.edu/epolicy/home>

³³ Gregory T. Gundlach (2001), *ibid.*

³⁵ Ronald H. Coase, *The Nature of the Firm* (1937) reprinted in OLIVER E. WILLIAMSON & SIDNEY G. WINTER (eds.), *THE NATURE OF THE FIRM: ORIGINS, EVOLUTION, AND DEVELOPMENT* (1991), (19);

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V. Markets, hierarchies, and ecosystems

The business world is witnessing the most profound change in organizational structure since the industrial revolution, as business learns how to organize distributed, global, open creativity. From the IBM/360 computer operating system to the current Web 2.0 movement, the ecosystem form addresses the seeming dilemma of how to free individuals to make creative contributions (the genius of the market), while joining the contributions of thousands, millions, and eventually billions of individuals to co-evolve their contributions within coordinated, integrated wholes (previously the unique contribution of the firm).

Markets and firms were well known by the time of Coase. His principal contribution was to point out that they are alternatives to accomplishing the same thing—coordinating production:

Outside the firm, price movements direct production, which is coordinated through a series of exchange transactions on the market. Within a firm, these market transactions are eliminated and in place of the complicated market structure with exchange transactions is substituted the entrepreneur-co-ordinator, who directs production. It is clear that these are alternative methods of coordinating production.³⁵

It is the contribution of today's researchers to point out that there is a third form of coordinating production. Just as the firm internalized markets under the visible hand of the entrepreneur, the ecosystem form internalizes systems of firms and the markets that connect them under the guiding hands of community leaders. In a business ecosystem, the leaders of a multitude of firms come together around a broad vision of a future they want to make happen. They understand that establishing this future will require both

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cooperation and competition among their firms. They are focused on co-evolving innovative combinations of technologies that solve important customer problems, and ecosystems to produce them. The co-evolved ecosystems incorporate combinations of markets and firms, with new as well as existing markets, and new as well as existing firms. Just as the firm brings production under the control of Coase's "entrepreneur-coordinator," the ecosystem brings co-evolution of production under the hand of a group of allied entrepreneurs and ecosystem leaders.

Markets facilitate transactions for goods. Hierarchies facilitate control over activities that produce goods. Ecosystems facilitate coordination of innovation in goods and the activities that produce them, as well facilitate managed co-evolution of the complex web of markets and hierarchies themselves. What differ, in the three forms of organization, are the ideal relationships that are sought, and the levels of analysis used to judge performance. In markets, the ideal is perfectly transparent transactions for contributions, i.e. goods and services. In hierarchies, the ideal is perfect control of tasks. In business ecosystems, the ideal is perfect co-evolution of innovation across a multitude of contributors.

Business history moves forward from a first order consideration of exchanges, to a second order focus on activities, to a third order emphasis on the ideas that guide activities: on designs, paradigms, patterns, and the trajectories of innovation that inventive contributors can imagine. The first order of consideration is the "invisible

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hand” of the market³⁶. The second order of consideration is the “visible hand” of the firm³⁷. The third order of consideration might be termed the “visible imagination” because the transactions that are coordinated are not primarily for goods or activities, but for commitments to the future. A business ecosystem is a distinct managerial approach for coordinating the co-evolution of agency, agency concerned with intra-and-inter-market improvement in goods and services, and with intra-and-inter-firm improvement in activities.

This vision of the world economy is here today in the information and media industry sectors, and is rapidly being replicated firm by firm, industry by industry, and sector by sector across the whole. Worldwide gains in universal education, a globally connected economy, the rise of information goods that travel without cost around the world; these and other factors are enhancing the speed of innovation in all domains, and thus the value of an organizational model that harnesses multiple innovations and puts them to work. “Small pieces loosely joined,” coined by social theorist David Weinberger,³⁸ has gone from being the watch phrase of technology revolutionaries to being a design principal championed by the world’s leading firms. As novelist and futurist William Gibson famously said, “the future is already here, it is just not very

³⁶ ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS (1776).

³⁷ ALFRED CHANDLER, THE VISIBLE HAND: THE MANAGERIAL REVOLUTION IN AMERICAN BUSINESS (1980)

³⁸ WEINBERGER, DAVID, SMALL PIECES LOOSELY JOINED: A UNIFIED THEORY OF THE WEB, (2002).

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evenly distributed.”³⁹ In a very real sense the ecosystem organizational form is how the future becomes distributed.

³⁹ William Gibson, NPR Talk of the Nation, November 30, 1999. Timecode 11min 55 sec. Available online at <http://discover.npr.org/features/feature.jhtml?wfId=1067220>

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