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The Network Imperative: Community or Contagion?

Paul Kleindorfer
Yoram (Jerry) Wind

Abstract

The rising importance of networks creates challenges and opportunities for business enterprises. On the one hand, networks lead to contagion and other risks, as can be seen in the rise of global terrorism and the spread of the 2008 global financial crisis. On the other hand, networks present opportunities for building community, as can be seen in the rapid rise of companies such as eBay, Google, Facebook, and other network-based enterprises. In this chapter, the editors of The Network Challenge point out that network-based models for business challenge the traditional firm-centric view of competencies and strategies that are the focus of most business education and management thinking. The authors challenge managers to consider the implications of networks in addressing issues such as risk management, strategy, marketing, human resources, and value creation. They emphasize the need to take diverse viewpoints on networks, including drawing upon fields such as biology, infectious diseases, and other areas with a long history of studying networks. Finally, the authors offer a summary of the key sections and chapters in The Network Challenge, which provide a broad, multidisciplinary view of networks and their implications for business. This chapter makes it clear that the opportunities and threats presented by networks cannot be ignored.

The network-based nature of our businesses and financial systems was clearly evident in the deep global financial crisis that unfolded across the summer of 2008. The collapse of U.S. subprime mortgage markets led to a ripple of effects across all sectors of the U.S. economy, necessitating the rescue of Bear Stearns, Fannie Mae and Freddie

Mac, and insurer AIG. The U.S. government passed a hastily developed \$700 billion bailout package designed to help unfreeze the banking industry, and other governments around the world have followed suit. The ultimate outcome of these emergency measures remains to be seen. However, network contagion and the complexity of cause and effect in a networked world are now routinely put forward as the reasons for the continuing crisis in financial markets. In explaining the conflagration of global markets, network dynamics have become the new phlogiston—a mysterious and ultimately fictitious substance used to explain combustion prior to the discovery of oxygen in the 1770s. We clearly need a deeper and more precise understanding of network interactions.

The network challenge can also be seen in the Chinese “toxic-milk scandal.” A few years ago, the logic of outsourcing manufacturing to China and other low-cost producers was irresistible. Any manufacturer who wanted to remain competitive needed to be able to meet the so-called “China price.” But a series of problems, including tainted pet foods, recalls of toxic toys, and the spreading scandal of tainted milk powder in China, have revealed the hidden risks of unbundling strategies, with their ensuing more complex supply chains and difficulties in governance of global networks. The results of the tainted-milk event will take months or even years to play out, with global recalls of baby formula, candy, and other food products containing powdered milk now underway. The sheer complexity of uncovering and recalling all potentially contaminated products that have been shipped globally is formidable. The economic damage to the reputation of China’s food industry will be staggering as the scandal has heightened concerns in the United States and Europe about the quality of Chinese products. One evident lesson from the toxic-milk scandal is that the spread of information and the measures that are needed to reestablish trust in global networks are of a different and far more complex nature than single-channel, controlled marketing and distribution networks of the past.

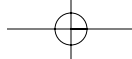
At the same time, networks have emerged as a tremendous source of value creation. Companies such as eBay, Google, Facebook, YouTube, and Twitter have risen from the primordial swamps of cyberspace to become major players based primarily on the power of their networks. Established corporations such as Procter & Gamble and Toyota are harnessing networks to tap into new sources of innovation around the globe or engage in word-of-mouth marketing for new products. The successful 2008 U.S. presidential campaign of Barack Obama has been attributed to his deft ability to mobilize and manage an unprecedented network of volunteers and contributors. Networks of suppliers are creating and delivering products through supply webs that stretch around the globe and can be reconfigured rapidly. Networks are now a powerful driver of value creation across society, but they follow different rules than command-and-control hierarchies. To tap into the value of networks, managers need a deeper understanding of how they work.



Companies and governments today face a dilemma: They cannot compete without networks to access resources or markets, but these networks present new risks and challenges that must be managed. The threats that face our world today—from financial crises to global competition to terrorist attacks to global diseases—are network-based. Effective solutions, in many cases, are also network-based. In such an interlinked world, we need a deeper understanding of networks to drive growth and manage risks. We need to understand what makes networks tick. This book is an attempt to provide a starting point for understanding the nature of networks and their implications for business. We brought together a broad cross section of researchers from diverse fields within business and outside—from biologists to antiterrorism experts—to help understand the nature of networks more broadly, and the specific knowledge that managers need to work in a networked world.

The Rise of Networks

A network may be defined mathematically as a set of nodes and the arcs that connect specific pairs of these nodes. These interlinked structures serve as conduits for information, human resources and capital, material flows—and associated risks. The origin of interest in networks in business and economics goes back to studies of transportation networks and mathematical programming solutions for various classes of production and transportation problems in the 1950s (e.g., Dorfman, Samuelson, and Solow 1958; Ford and Fulkerson 1962). Network-based theory also developed rapidly in sociology (as in the work of the renowned sociologist Coleman 1990). The early work was typically grounded in the analysis of a prespecified network, but a number of important contributions have now emerged regarding endogenous network formation (the activation of potential links between various nodes) and information exchange in economic and social networks (see, for example, Jackson 2008). Researchers in other fields have also addressed network phenomena, either explicitly or implicitly. This book presents many of these perspectives on networks. We have not tried to reduce all of these perspectives to a single, general definition of network-based effects, but all of these perspectives imply informational and resource links between actors in some given context. These links, whether preexisting or dynamically activated, imply interdependencies between these actors (see sidebar). It is the study of the nature and evolution of these interdependencies that has provided new insights on the changing landscape of global business, and that provides the major backdrop and rationale for this book.



Networks, Interdependencies, and Externalities

In economics, interdependencies are often referred to as *externalities*. Externalities occur (typically in choice contexts involving resource allocation or economic design decisions) either when the payoffs or information of one agent are influenced by actions of other agents (a pecuniary or informational interdependency or externality) or when the set of feasible actions of one agent are influenced by actions of other agents (a technological interdependency or externality). Sometimes several types of interdependency occur in the same resource allocation problem. Social interdependencies (wherein payoffs to certain agents are influenced by their observed compliance with norms or depend on kinship links) are an example of pecuniary interdependencies, but theories regarding such interdependencies obviously have their own special character. Network interdependencies are a specific form of interdependency in which the effects of the interdependency (pecuniary, informational, technological, or social) operate through identifiable agents/nodes and pathways/links. The specific character of networks (and their interdependency effects) derives from the role played by the structure and typology of the nodes and links connecting individual agents in a specific network. Network theory has come to mean many things in the past several decades, including endogenous formation of links and nodes, information transmission in networks of given structure, computational limits when various agents in a network structure can perform certain local calculations only, social contagion effects, and so forth. All these and more are reflected in the chapters in this book, and each area discussed in the book is also evolving. Thus, we are not going to attempt to provide a general and all-encompassing definition of what network effects are. Rather, for the general purposes of understanding the chapters in this book, you should simply think of networks in the common English-language use of the term as interlinked structures that serve as conduits for information, human resources and capital, material flows, and associated risks.

Sharp declines in the cost of communications, information technology, and logistics have led to explosive growth of outsourcing and offshoring, as global work migrates to where it can be completed best at lowest cost. Cross-border trade has skyrocketed. Total manufacturing exports increased 10% annually between 2000 and 2006, growing at twice the rate of world GDP.¹ While global business once moved from developed to developing

¹ "International Trade Statistics 2007," World Trade Organization, http://www.wto.org/english/res_e/statis_e/statis_e.htm.

countries, now global competition means “competing with everyone from everywhere for everything,” as Boston Consulting Group’s Hal Sirkin, Jim Hemerling, and Arindam Bhattacharya write in their book *Globality* (2008). We have seen waves of mega M&A activity that have created new industries (AOL Time Warner) and reshaped existing ones (Chrysler and Daimler-Benz, Sony and Columbia Pictures, JP Morgan and Chase).

Consumers are networked through interactive and empowered relationships, including the rapid rise of social networking sites such as MySpace and Facebook. By 2009, there are expected to be as many as 250,000 social networking sites. On eBay alone, more than 276 million users bought and sold more than \$59 billion in products in 2007, almost equal to the \$61 billion in sales by Target in the same year.² eBay sellers trade more than \$2,000 in merchandise *every second*. New multinational regulatory models and business models are emerging to meet the network challenge. Investors also are placing a high value on network-based firms, as shown by Microsoft’s \$240 million purchase of a stake in social networking firm Facebook in October 2007, based on a \$15 billion valuation of the privately held company that was launched less than four years earlier (Greene 2007).

Companies are using networks as sources of innovation and customer service. We are seeing the rise of consumer-generated advertising and consumer-led R & D and design. Dell’s IdeaStorm site has received thousands of suggestions from consumers for new products or services, and consumers then vote for those they think are most important (www.ideastorm.com). As Don Tapscott and Anthony D. Williams write in *Wikinomics* (2006, 10), “We are entering a new age where people participate in the economy like never before. This new participation has reached a tipping point where new forms of mass collaboration are changing how goods and services are invented, produced, marketed and distributed on a global basis. This change represents far-reaching opportunities for every company and for every person who gets connected.”

The classic network battle in videocassettes, in which Matsushita triumphed over Sony’s superior Betamax technology in the 1970s by building a network of content and equipment, has given way to more complex battles. Even as Sony was battling with Toshiba for next-generation DVD standards (Blu-ray versus HD-DVD), companies such as Apple and Netflix were building their own networks for online movie downloads and other new channels for delivering entertainment (Anthony 2008). Standards wars are just part of a broader competition of network against network.

² eBay Marketplace Fast Facts, http://news.ebay.com/fastfacts_ebay_marketplace.cfm; Target Corp. Press Release, <http://news.target.com/phoenix.zhtml?c=196187&p=irol-newsArticle&ID=1105552>.

No One Is Exempt

Every organization is affected by the rise of networks. There are very few quiet backwaters where managers can comfortably take a firm-centric view of their work. This applies to all industries, all sizes of firms, and all countries. All branches of the military are moving to more network-centric models in institutions that had once defined “command and control” hierarchical structures. Networks have both direct and indirect impacts on strategy and competencies, as the chapters in this book make plain. Networks are transforming markets and many of the most important modes through which business and government organizations generate value, assume risks, ensure their long-term viability, and interact with their environment.

We are just beginning to recognize the implications of these changes for how we think about companies and how we design and run our businesses. Companies have experimented with a variety of new models to take advantage of these network opportunities, but we are still in the early stages of discovering what new opportunities and risks are presented by this shift from a firm-centric view to a network-centric view. This book considers some of these implications and opportunities.

Challenging the Theory of the Firm

In this world, the traditional view of the firm no longer serves us well. Adam Smith’s famous pin factory, Henry Ford’s automobile plant, and Peter Drucker’s General Motors have defined how we think about management and strategy. The corporation has been at the center of management study and thinking since the birth of modern business research and education. Our management textbooks are built around the firm. Our laws are based on the corporation. And yet the traditional firm is increasingly an anachronism in a world of diverse and fluid connections—a networked world. New technologies and new business models have transformed the corporation.

The focus of the traditional theory of the firm was on “transformational efficiency” and market power, purchasing inputs and transforming them efficiently into products and services that could be marketed profitably to the firm’s customers. The firm and the efficiency of its transformational processes, and its ability to command premium margins in the market, were the focal points of strategy. What has happened in the unbundled economy of the twenty-first century is that this “corporation as king” model has given way to a much more complicated array of interorganizational systems for innovation, for production, for marketing, and ultimately for connecting with customers and

investors. On the supply side, outsourcing, offshoring, and the Internet have led to new connections to provide a variety of services, from accounting to manufacturing. On the demand side, open architectures and empowered consumers are driving both innovation and customization of existing products and their marketing. In the process, many corporations have come to view their profits and their risks not in terms of what they control internally, but in terms of their relational capabilities to the networks in which they are embedded.

These networks have done more than connect nodes of independent companies. They have led to second-order and third-order effects that are absent from bilateral transactions. Networked enterprises raise issues of group influence, cascading, contagion, and interdependent risks that cannot be controlled through standard mechanisms. As shown by eBay and other new business models, the distinctions between companies and markets have been blurred. Some of the challenges of the networked world cannot even be considered from a firm-level perspective, any more than a complex ecosystem can be understood by studying one of its actors, or a chemical reaction can be understood by studying a single reagent. The rise of networks has fundamental implications for business strategy and competencies.

Strategy and Competencies

Business strategy has been built around the firm. Michael Porter's (1985) famous Five Forces model puts the firm at the center, and other forces outside. Now the firm is part of the network and the five forces are in the network itself. Concepts such as barriers to entry have less meaning, and the idea of rivalry, buyers, and suppliers is transformed by an environment of "co-opetition" (Brandenberger and Nalebuff 1997).

Core competencies also look different from a network view. Since Hamel and Prahalad identified the importance of core competencies, these competencies have been primarily discussed at the firm level. Companies focused on building and protecting competencies that could not be easily imitated by rivals and could be leveraged across different businesses (such as Honda's expertise in small engines used in products from motorcycles to snowblowers). But as the world has become more networked, the competencies that are important are not so much the ones a company owns as the ones it can connect to.

New technologies, as discussed by Thomas Friedman (2005), are flattening the world. A small village in China or a tiny shop on the back streets of Mumbai can tap into global networks to identify current bids for its products or purchase manufacturing

inputs, competing on a relatively level playing field. Entrepreneurial startups can compete against large, well-funded incumbents. Consumer products firm Method (www.methodhome.com), for example, worked with a network of global partners to build a \$100 million business in just a few years, competing effectively against giant rivals such as Procter & Gamble. An amateur with a video camera can create content that can compete with large entertainment firms. Large companies can partner with these smaller firms, drawing together swarms of bees into a single productive hive. The challenge for large companies is to develop network-centric business models and strategies to harness the power of the broader network and harvest its usufruct (the right to derive benefit from property that belongs to another person as long as the original property is not damaged).

A Time of Revolutions

The rationale for the firm as an economic and legal entity finds its roots in the very beginnings of modern economics. The cornerstone of this view is Adam Smith's great treatise, *The Wealth of Nations*, published in 1776 on the eve of the birth of the American Republic. It was motivated by Smith's view that the changes that were beginning to be visible in the textile and manufacturing sectors of Britain would transform the economic activity of the world. A new theory was required to think about this. His theory saw economic value as being driven by two fundamental economic factors: "specialization" to achieve economies of scale, and "trade" to rebundle into useful products what specialization had unbundled.

We stand again in a time of revolutions. In the Internet age, the unbundling and rebundling foreseen by Smith has been facilitated by new communications and information platforms. Many of the nontechnical barriers to trade are being dismantled by regional innovations such as NAFTA and the European Union, and by supranational organizations like the WTO. China, India, and other emerging economies are growing rapidly in an interconnected world. Dubai and Abu Dhabi are planning their growth based on serving as a hub for countries within an 8-hour flight. In networked enterprises, the clear lines of specialization and trade have become blurred along with the lines between enterprises.

Perhaps the modern equivalent of Smith's pin factory is Li & Fung in Hong Kong. For a company that produces more than \$9 billion in clothing, toys, and other products for some of the world's leading brands, a competency in *manufacturing* might be considered to be central. Yet the company does not own manufacturing plants or employ seamstresses. Instead it orchestrates a network of thousands of suppliers around the globe to

create supply chains on-the-fly. Its core competency is not in specialized manufacturing process. Instead, its most important competency is in designing and managing the overall network, what company leaders Victor and William Fung call “network orchestration.” This is its area of specialization.

Peter Drucker, exploring the depths of what was the twentieth century’s quintessential modern corporation, General Motors, led the way into an understanding of modern management principles that still shapes the way managers are educated and practice. Today, General Motors offers a case in point about how the world has changed fundamentally. It has struggled to keep up with rivals, such as Toyota, with more skill in managing networks for innovation and operations. This new networked organization is, to echo the words of GM’s infamous advertising campaign of the late 1980s, “not your father’s Oldsmobile.” The past two decades have seen immense changes in the forces and institutions that govern economic activity. These changes are leading to a new theory of the firm.³

Revolutionary times can be quite dangerous. While networks present opportunities, they also raise a number of risks and challenges as exemplified by the discussion of the financial crisis and the tainted-milk problem that opened this chapter. We have seen waves of change in governance, enterprise risks, and social structures. There are concerns about political risks from corruption, nonstandard accounting practices, and discriminatory regulation in international transactions (www.opacityindex.com). Accountability and transparency can be lost in the complex web of networks. We face network threats of terrorism, diseases, and global warming. These risks are the downside of the opportunities reflected by the network revolution. This revolution has provided huge increases in access to resources and markets, enabled by networks. The same revolution has exposed companies and economies to new complexities and risks because of the increased interdependencies implied by networks. Navigating and balancing the trade-offs between these opportunities and risks is the central challenge for management posed by the new age of networks.

Nodes and Networks

Companies were once seen as self-contained nodes connected with other enterprises; they are now increasingly an integral part of networks. New technologies and logistics platforms have allowed for the unbundling of the vertical organization. This is

³ For an excellent summary of the foundations of the theory of the firm, see Roberts (2004). For a contrasting net-centric view, see Crook, Kleindorfer, Lindegren, and Wind (2006), which served as the background paper for the “call for papers” for the workshop and conference underlying this book.

changing relationships of companies with one another, their employees, customers, and other stakeholders. What happens across organizations is often more important than what happens within them. This transformation and its implications for managers and researchers are the subject of this book.

As our attention shifts from companies to the white space and relationships between them—like the famous optical illusion that shifts from two faces to the vase contained between them (see Figure 1-1)—we need a more fundamental rethinking of our view of business. These dramatic shifts mean that we need to challenge our traditional mental models of management (Wind and Crook 2004). Holding to old models that no longer fit the environment can lead to missed opportunities or the failure to see potential threats.

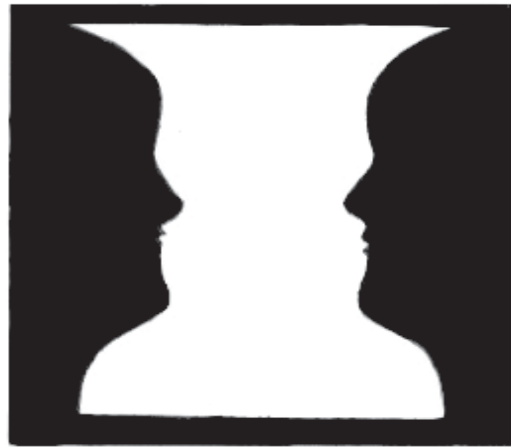


Figure 1-1 Node or network? Two faces or a vase? As our focus shifts from the firm (nodes) to the network, the white space between enterprises has become increasingly important. Is it time for a shift in our view of strategies and competencies?

The node and network exist together. The faces and the vase are both there, so sometimes it makes sense to look at the firm, sometimes the network. The fortunes of companies still rise or fall based on their own earnings and stock performance—not the strength of their networks—although networks are playing an increasing role in their performance. Investors still buy stock in companies, but the extraordinary valuation of a company such as Google depends in large part on the network in which it is embedded. Like the wave or particle theory of light in physics, both the node and the network view have a place in explaining the phenomenon of our current business world. In particular, the success or failure of many modern enterprises cannot be well understood at the firm level. They demand a network view.

The Network That Is This Book

It takes a network to understand a network. In this book, we have assembled scholars from business disciplines and experts from outside to help you understand network-based phenomena and its implications for management. These experts offer a multifaceted view of the emerging implications of our networked world. We have drawn together the broadest possible kaleidoscopic view from diverse disciplines in social sciences; computer, natural, and life sciences; and diverse business disciplines. The contributors came together for a major conference at the Wharton School in November 2007, sponsored by the INSEAD-Wharton Alliance, where they brought their different views together in a common crucible. The result is this book. Let us briefly examine insights that will be explored by these authors in the following sections of the book.

Part I: The Network Challenge

The first section of the book considers the way networks challenge our fundamental views of organizations, leading to a rethinking of innovation, knowledge management, and leadership. Among the challenges presented by networks are these:

- **Challenge of network-based innovation**—In Chapter 2, “Creating Experience: Competitive Advantage in the Age of Networks,” **C.K. Prahalad**, who was a pioneer in framing the discussion on core competencies more than two decades ago, discusses the role of networks in the design of product and service offerings. He considers how the locus of innovation has moved from the firm to the network and presents examples of networked models that have been applied in medical technology, such as cardiac pacemakers, and in an innovative system for diabetes management in India. Instead of merely assembling a supply chain to produce a product, companies can bring networks together to create a customer experience and value.
- **Challenge of knowledge management**—Networks have tremendous power for remembering and sharing knowledge, but **Alan Kantrow** notes in Chapter 3, “Knowledge as a Social Phenomenon: ‘Horse Holding’ and Learning in Networks,” that sometimes networks need the ability to forget and examines the role of networks in knowledge management strategies. Organizational routines often continue in force long after the old practice is obsolete. But memory is rarely lost entirely. It usually lingers, in distributed fragments, in an organization’s social networks and can, if needed, be reassembled.

- **Challenge of network-based leadership**—Networked organizations, particularly cross-cultural networks, present challenges for leaders, as **Russ Palmer** discusses in Chapter 4, “Cross-Cultural Leadership in Networked Global Enterprises,” where he considers the new leadership that is needed. The kind of leadership style that works in global networks is different from the “do it and do it now” approach that might work in hierarchical organizations. Leaders need to understand that what works in one culture may not work in another.

Part II: Foundations

While business organizations have begun to recognize the need to build and understand networks, business certainly didn’t invent networks. The second section of the book turns to rich and varied research on networks, from online dating to food chains to leaf-cutter ants. Among the insights are these:

- **With the rise of social networks, you’ve lost control**—Beginning with a discussion of a panicked run on Hong Kong cake shops, **Dawn Iacobucci** and **James Salter** consider the implications of the rise of “social networks” in Chapter 5, “Social Networks: You’ve Lost Control.” In a discussion that moves from online dating to marketing, they show that as power shifts from firms to social networks, companies have less control over their own destinies and need to pay more attention to networks.
- **Size and linking improve productivity and survival in biological networks**—Biological networks are as old as life, and in Chapter 6, “Biological Networks: Rainforests, Coral Reefs, and the Galapagos Islands,” **Sonia Kleindorfer** and **Jim Mitchell** take us on a journey into rainforests, coral reefs, and Darwin’s *Finches on the Galapagos Islands* to understand the structure and evolution of biological networks. They note that biological networks adapt over time, network size is related to productivity, and networks need a balance of strong and weak links to survive.
- **From bees to ants, networks need a system of communication**—The impact of information and communications on network dynamics did not arrive with the rise of computers and cellphones. In Chapter 7, “Information Networks in the History of Life,” **Robert Giegengack** and **Yvette Bordeaux** consider lessons from bee dances to the complex agricultural communities of leaf-cutter ants. These biological networks have systems for filtering noise, specialized roles, and mechanisms for signaling, all of which are also important to human networks.

- ***Cooperation and competition lead to different outcomes in networks***—Beyond natural biology, our computer “creations” have their own evolving life in the form of artificial intelligence. In Chapter 8, “Artificial Intelligence: How Individual Agents Add Up to a Network,” **Steve Kimbrough**, using agent-based models, shows how outcomes from strategies of cooperation and competition depend on the surrounding environment and on the nature of the interactions embodied in the information and resource networks that connect agents.

Part III: Innovation and Coordination in Networks

Networks are transforming our view of innovation and coordination. After this broad view of networks, in the third section of the book, we turn our attention to specific business implications, beginning with innovation and coordination. Innovation, product design, and new product development are no longer centered in a single firm, so companies need to understand how to get the best ideas and develop products through networks. Among the insights are these:

- ***Different networks are needed for different types of innovation***—In Chapter 9, “Network-Centric Innovation: Four Strategies for Tapping the Global Brain,” **Satish Nambisan** and **Mohan Sawhney** show how organizations can tap into the “global brain” for innovation. But they make it clear that not all networks are the same. A jazz band and an orchestra are both networks but operate in very different ways. In particular, the writers identify four models of network-centric innovation—which they call Orchestra, Creative Bazaar, Jam Central, and MOD Station—and outline how companies can select, prepare for, and pursue the approach that best fits their particular business and innovation context.
- ***Design networks need coordination***—Complex products such as airplanes or automobiles are now designed by networks of teams working on different components, often across organizations and countries. The challenge in managing these networks is to decompose the project into manageable pieces but then coordinate the entire network to produce the best overall design. In Chapter 10, “Coordination Networks in Product Development,” **Manuel E. Sosa** considers approaches to engineering design based on the information and resource requirements of a given design problem, as captured in tools such as the design structure matrix to drive decisions such as organizational team structure and modularity in design.

- ***Networks sometimes need “inefficient” overlaps to ensure broad search and avoid lock-in***—In Chapter 11, “Organizational Design: Balancing Search and Stability in Strategic Decision Making,” **Nicolaj Siggelkow** and **Jan Rivkin** examine the intersection between organizing and strategizing. Centralized decision making may be more stable and efficient but can lead to “premature lock-in” rather than a broad search for fresh perspectives. Using a simulation approach motivated by network-based approaches to artificial intelligence, they look at how “inefficient” overlaps across a network can sometimes be desirable in balancing search and stability.

Part IV: Strategy and Business Models

Networks lead to new views of strategy and new business models, as examined in the next section of the book. Among the insights are these:

- ***Organizations increasingly must recognize the “network effects” of complexity theory in developing strategy***—Complexity theory addresses the “network effects” that result from interactions between many independent actors. In Chapter 12, “Complexity Theory: Making Sense of Network Effects,” **Colin Crook** explores issues such as fads and crowds, reflecting the spread of shared information and technology, and the use of agent-based simulations to understand interaction effects in networks. He considers the implications of complexity theory for business, and how network effects influence key management areas such as making sense of complex environments, strategy formulation, and organization design.
- ***Business is moving from supply chains to supply networks***—As manufacturing supply chains have moved from vertically integrated factories to diffused networks, manufacturers need to manage complex, global webs of suppliers. In Chapter 13, “Supply Webs: Managing, Organizing, and Capitalizing on Global Networks of Suppliers,” **Serguei Netessine** examines how companies such as Airbus and Boeing have used technology to coordinate and integrate far-flung supply networks.
- ***Marketing is increasingly network-based, depending on “social contagion”***—In Chapter 14, “Leveraging Customer Networks,” **Christophe Van den Bulte** and **Stefan Wuyts** consider the increasing role of networks in marketing, accelerating the spread of new products, strengthening brand beliefs and preferences, improving corporate status and reputation, coordinating distribution channels, and accessing resources. They consider the key role of social contagion in marketing.

- ***Networks create and distribute value in new ways***—In contrast to firm-centric views of value creation such as Porter's value chain, network-based business models build value through different mechanisms. In Chapter 15, "The Business Model as the Engine of Network-Based Strategies," **Christoph Zott** and **Raffi Amit** identify four major interlinked value drivers—efficiency, complementarities, lock-in, and novelty—and discuss their role in new business models that are consistent with network-based strategies.
- ***Networks can improve the organization's "peripheral vision" to see opportunities and threats at the edges of the business***—In addition to their direct function, many networks serve as antennae to scan, sense, and adapt to new and important signals from the organization's strategic environment beyond its core focus. In Chapter 16, "Extended Intelligence Networks: Minding and Mining the Periphery," **George S. Day**, **Paul J. H. Schoemaker**, and **Scott A. Snyder** explore how companies can use existing networks and design new ones to gather intelligence and create "strategic radar" to recognize emerging threats and opportunities sooner.

Part V: Organizing in a Networked World

Networks are changing the design and management of our organizations. The next section of the book explores how networks demand new capabilities in orchestrating networks, managing a new generation of networked employees, finding and hiring staff, and managing alliances. Among the insights are these:

- ***Core capabilities may be located outside the organization, drawn together through capabilities in "network orchestration"***—In Chapter 17, "Network Orchestration: Creating and Managing Global Supply Chains Without Owning Them," **Jerry Wind**, **Victor Fung**, and **William Fung** describe the innovative model of Li & Fung for "competing in a flat world" by orchestrating a far-flung network of suppliers brought together into temporary networks to fulfill a specific customer order. Its connective capabilities in "network orchestration," in contrast to traditional views of core competencies, allowed the company to become one of the top global contract manufacturers without owning a single factory.
- ***Companies need to change the way they manage "instant messaging generation" employees***—The IM generation has different views of work, loyalty, decision making, and even reality. In Chapter 18, "Managing the Hyper-Networked "Instant Messaging" Generation in the Work Force," **Eric K. Clemons**, **Steve Barnett**, **JoAnn Magdoff**, and **Julia Clemons** consider how organizations need to adapt their training, their managerial styles, and their expectations of employees' motivations.

- ***Effective human resources management depends on harnessing networks***—While HR management has traditionally focused on the individual, in Chapter 19, “Missing the Forest for the Trees: Network-Based HR Strategies,” **Valery Yakubovich** and **Ryan Burg** point out that core HR processes such as recruitment and hiring, training and development, performance management, and retention all depend on networks. Employees come to organizations through networks, “structural holes” within organizations can challenge employees to develop new skills, and networks also increase the potential for “lift outs,” in which one departing employee takes many others. Effective human resources management requires seeing this larger forest instead of focusing only on the trees.
- ***Relational capabilities are crucial to successful alliances***—In a networked world, alliances are central to success, but more than half of alliances fail. In Chapter 20, “Relating Well: Building Capabilities for Sustaining Alliance Networks,” **Prashant Kale**, **Harbir Singh**, and **John Bell** discuss their research on the importance of building relational capabilities to design and manage alliances effectively. Using the case of Royal Philips, they explore the role of strategy, structure, systems, people, and culture in alliance success, underlining the central role of relational capabilities in an increasingly networked world.

Part VI: Network-Based Sources of Risk and Profitability

Networks transform our view of risks. Risk management is less about fortifying the walls around a single firm and more concerned with understanding how many links among network partners lead to greater security or vulnerability. The next section explores insights on this challenge, including these:

- ***Interlinked global financial systems create new risks***—Our financial systems are networks, and today these networks have grown increasingly complex and interlinked. In Chapter 21, “Networks in Finance,” **Franklin Allen** and **Ana Babus** examine how a network perspective can help you understand and address challenges such as financial contagion and freezes in the interbank market. They examine how social networks can improve investment decisions and corporate governance, and the role of networks in distributing primary issues of securities.
- ***Risks in networks are interdependent, as are solutions***—The effectiveness of airline security depends on the level of security of the “weakest link” in the network, as tragically demonstrated when a bomb introduced on a Malta Airlines flight made its way onto the trans-Atlantic PanAm Flight 103. In Chapter 22, “The Weakest Link: Managing Risk Through Interdependent Strategies,” **Howard**

Kunreuther explores how such interdependent security risks often require interdependent solutions, involving all parts of the network and sometimes requiring a combination of public and private strategies.

- ***Global logistics networks present new risks and demand new strategies***—As global logistics networks have grown and developed, they also have presented new challenge in managing risk and volatility across these broad, global networks. In Chapter 23, “Integration of Financial and Physical Networks in Global Logistics,” **Paul Kleindorfer** and **Ilias Visvikis** discuss changes in logistics and financial instruments such as derivatives that have emerged to value and hedge the cost of capacity and services in these markets. The approaches to address risks in global logistics illustrate the emerging tools and competencies that have been needed to manage new network risks.
- ***Networks can lead to battles between those who seek greater control and those who advocate greater freedom***—Although telecom is a “networked” industry, incumbents have often fought against a network view of strategy and business models. In Chapter 24, “Telecommunications Network Strategies for Network Industries,” **Kevin Werbach** contrasts the worldview of “Monists” such as AT&T, who see the infrastructure as inseparable from the network, and “Dualists” such as Google, who see the network and its applications as distinct from the underlying infrastructure. He suggests that a more modular future might bridge the gap between those who seek to own and capitalize on the network and those who seek to expand it through more neutral offerings.
- ***Addressing political and social risks requires a deep understanding of networks***—Companies such as an oil company seeking drilling rights face complex risks from interactions among political leaders, media, and social activists. The company’s fate often is in the hands of a complex set of actors. In Chapter 25, “Network-Based Strategies and Competencies for Political and Social Risk Management,” **Witold Henisz** examines how information about the structure of political and social networks can be integrated into data acquisition and analysis, as well as strategy implementation, to better manage political and social risks.

Part VII: A Double-Edged Sword: Contagion and Containment

Networks have a dark side. They speed the flow of communication and commerce, but diseases, terrorism, computer viruses, and other threats can ride on these same smooth rails. Extended chains with more partners in different countries create channels for contagion. The final section of the book explores the dark side of networks and strategies for addressing challenges, including these:

- ***Network-based global terrorism demands a network-based solution***—Al-Qaeda and other global terrorist networks have moved from hierarchy to a resilient, network-based structure and leadership. In Chapter 26, “Terrorism Networks: It Takes a Network to Beat a Network,” **Boaz Ganor** examines how the evolving structure of these networks is redefining global terrorism, and how antiterrorist agencies have had to build their own networks to address them. As he notes, “It takes a network to beat a network.”
- ***Diseases spread through global networks, so countries need to join together to prevent them***—In Chapter 27, “Global Diseases: The Role of Networks in the Spread (and Prevention) of Infection,” **J. Shin Teh** and **Harvey Rubin** examine the role of global networks of air travel and connections in the spread of infectious diseases. Networks can help to meet these challenges, such as those that contribute to the development and distribution of drugs and vaccines for infectious diseases. Network-based analyses help to better model the spread of diseases. The authors also argue that effectively addressing the risks of global infection requires a collaborative international solution, or “global compact,” that will allow effective diagnosis, prevention, and treatment of infectious diseases.
- ***Interpersonal social networks spread diseases but also can help prevent them***—In Chapter 28, “Lessons from Empirical Network Analyses on Matters of Life and Death in East Africa,” **Jere R. Behrman**, **Hans-Peter Kohler**, and **Susan Cotts Watkins** explore the impact of informal social networks in preventing HIV infection in Kenya and Malawi, using longitudinal quantitative and qualitative data from more than a decade. They show that both the context (e.g., the degree of market development) and the density of networks matter (possibly interactively), as well the endogeneity of network partners.

These chapters, collectively, represent a multidimensional view of the shifting landscape. They help managers to raise important questions about a networked world and wrestle with the core issues they need to address in meeting the network challenge: How do we need to rethink our approach to innovation? What new coordination mechanisms do we need? What strategies do we need to compete effectively network against network rather than firm against firm? What business models will help us create and appropriate value in a networked world? How do we need to redesign our organization and change our approach to managing our employees? What new risks are created by networks, and how can we address their dark side?

As noted previously, these approaches are not either/or. We are not in a completely networked world. In each area, we need to be able to see the network as well as the individual nodes. Both perspectives are accurate and important. Firm-level strategies and

competencies still need to be part of management thinking, but these decisions need to be made in the context of the broader network.

Meeting the Challenge of Networks

Shifting thinking and action is particularly challenging for mature and established companies. In our discussion of these issues with senior executives, they have raised practical questions such as this: How can managers move from the theory of network effects to implementing these concepts with a management team when the next item on the agenda is the quarterly financials? Ground-up new ventures such as eBay, Wikipedia, and Google have brought a radically different worldview, but their lack of a legacy has been an advantage in this process. Established firms face the more daunting challenge of making the leap from the firm-centric world to a networked world, without undermining their existing business and commitments of current stakeholders in it.

In some cases, the changes may appear at first to be incremental. This can lead to the “boiled frog” syndrome, in which managers don’t recognize the significance of the change until it is too late. The development of the Internet itself percolated behind the scenes for many years, confined primarily to academic and military circles, before the minor innovation of the web browser made it a transformational force in business. This is what Ron Adner and Dan Levinthal (2000) have called “technology speciation,” using a term from evolutionary biology to describe how technologies are transformed by a leap into a new domain. What might initially have looked like a difference of degree becomes a difference in kind. It appears that we may see the same kind of speciation with respect to networks, in which a number of small changes add up to very different models for business and different approaches to developing strategy and competencies.

The speed of network development is one uncertainty, and another is the models for networks that might emerge. Although we sometimes discuss “networks” as if they were a single concept, the models for networks that could emerge—and are emerging—are diverse. We need to understand the differences among these networks. Some, for example, may operate like formal orchestras, whereas others may more closely resemble the improvisational performance of a jazz quartet. Some will need conductors, whereas others will self-organize. What are the different types of networks and which ones work best in a given situation?

Some of the implications of this shift to a network-centric view are already beginning to emerge, as illustrated in Table 1-1.

TABLE 1-1 Network-Centric Thinking

	Firm-Centric Thinking	Network-Centric Thinking
Leadership	Command and control	Self-organizing/empowered
Value creation	Firm-centric products	Network-centric experience
Innovation	Internal R & D	Open innovation
Core competencies	Firm-based core competencies	Network orchestration and learning
Competition	Firm against firm	Network against network
Risks	Local and direct	Systemic and interdependent
Finance	Appropriating rents	Building and sharing value
Marketing	Mass marketing	Mass contagion
Operations Focus	Efficiency	Flexibility
HR	Superstars	Supernetworks

The insights summarized in Table 1-1 are just the beginning. The role of networks and our understanding of them continue to evolve rapidly. This is largely uncharted territory, both for business disciplines and for the social and natural sciences that inform these disciplines. We are all learning what this world means. The challenge of understanding networks is like the old fable of the blind men trying to provide an accurate description of an elephant—except that it is a herd of elephants and they are all in motion, and they have not only observable physical characteristics but also unobserved motivations, knowledge, and attitudes. Any attempt to freeze the action to see what is going on or predict where the herd will go next, though useful, is necessarily limited. The act of concentrating on a specific aspect of networks such as human resources or alliances, or a type of networks such as terrorist networks or biological networks, necessarily leaves out part of the picture. We hope that by gathering individual experts from many disciplines and probing this phenomenon from many angles, we can overcome some of the blind spots that each may bring to the task and help illuminate the true nature of these networks and their significant implications for business.

The implication of networks ranges from the survival and growth of our businesses to the future of the planet, as we address highly networked issues such as international trade, global warming, and terrorism. Understanding networks is critical at every level, from personal decisions to business decisions to the broadest policy issues facing our world. We hope this book will help put the changes that are playing out in the structure of the global economy into a broader context for managers facing the challenges of leadership in the emerging networked world and for our colleagues as we attempt to shed new light on these phenomena through research.

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