

## Chapter 2

### COMMUNICATIONS AND INNOVATION, BUSINESS ORGANIZATION AND TERRITORY

#### A Synthesis

*“Such phrases as the Romantic Movement, the Mercantile System, and the Second Hundred Years’ War have been of real value in helping students visualize and coordinate historical movements and influences. If there were a board of historians empowered to pass upon such labeling, one might propose to them another phrase -- the ‘Communication Revolution’.”*

Robert Albion, (1932)

*“Whenever the economy or an industry or some firms do something that is outside the range of existing practice, we may speak of creative response....Creative response changes social and economic situations for good, [and] is an essential element in the historical process.”*

Joseph Schumpeter, (1947)

*“Firms are not islands but are linked together in patterns of cooperation and affiliation....Co-operation may come close to direction when one of the parties is clearly predominant;”*

G.B. Richardson, (1972)

#### From Communications to Territory

The comparative story of Swift and Dell rests upon the premise that technologies of transport and communications play a central role in economic life (Bell, 1979). They shape the basic parameters of efficiency for firms in producing, buying, and selling by recalibrating the costs of securing information from the market, shipping products across distance, and reaching out to other agents in the marketplace. Historically, new technologies of transport and communications promote more efficient types of economic activity by creating new and less costly systems of market access for firms across space, and by reconfiguring the territorial limits of markets in which the profit-seeking activities of firms take place. As market boundaries shift from changes in transport and communications systems, and as opportunities emerge in such reconfigured markets spaces for firms to perform more efficiently, firms are able to change the way they operate and compete. Such are the basic outlines of the stories at Swift and Dell.

During the last half of the nineteenth century, and the final years of the twentieth century, rail and telegraph technology, and Internet technology created communications revolutions that assumed the role of what Schumpeter described as “leading sectors” in the economy (Cohen et al., 2000: 9-11, 32). More than simply high growth industries, these lead sectors ignited more widespread patterns of innovation among firms in both periods. This pattern included more than new products and new production processes. Businesses used breakthroughs in transport and communications to reorganize the structure of the firm itself. They developed pioneering forms of industrial governance that resulted in entrepreneurial types of business organization. These enterprises, in turn, used the power of administrative coordination rather than markets in creating distinct geographies of profitmaking.

This chapter develops a taxonomy of this route from communications revolutions, to innovation and organizational change, to territorial transformation across different historical periods. This taxonomy emphasizes how the innovations of Swift and Dell are not random acts of entrepreneurial genius. These innovations instead conform broadly to a process of technological change, organizational transformation and territorial formation in which individuals act as agents in a more complex structural setting. As a prelude to this taxonomy, this chapter critiques some of the principal theoretical contributions to the three literatures -- the literatures on innovation, firms as business organization, and the communications revolution -- comprising this route. What follows is how these three literatures converge in creating an appreciative model of communications and innovation, business organization and territory.

### **Innovation and Technological Change**

It is indeed an irony how the notion of innovation, and the idea of markets have somehow become inextricably linked in the collective psyche of contemporary society as the twin drivers of the capitalist economy. So strong is this association that according to orthodox economic policy prescriptions, creation of the latter begets the phenomenon of the former. While it seems incontrovertible that capitalist development occurs through a market process along with the process of innovation, it is also true that these two concepts, innovation and markets, in many ways share at best an uneasy mutual affiliation.

That the capitalist economy is driven fundamentally by the process of innovation rather than an equilibrated allocation process of market-clearing, is perhaps the greatest legacy left to economic theory by Joseph Schumpeter. In contrast to neoclassical economists, Schumpeter insisted that the capitalist process was not one of equilibrium in which markets adjusted according to the price system and laws of supply and demand. Capitalism instead was essentially a disequilibrium system in a state of continuous turbulence, driven by the innovative activities of firms and individuals in creating new products and processes, new business organizations and markets. Schumpeter crafted his celebrated metaphor of “creative destruction” to describe this process of innovation and the disruptive impacts of these activities underlying this phenomenon.

This view of the market and the development process placed Schumpeter well outside the economics mainstream. The problem erroneously being visualized by most economists, insists Schumpeter “is how capitalism administers existing structures, whereas the relevant problem is how it creates and destroys them” (Schumpeter, 1942: 84). This destructive and creative process of innovation was, for Schumpeter, unevenly spread over time, tending to occur in periodized clusters or waves. Such unevenness gave an historical dimension to both innovation and capitalist development (Rosenberg, 1982: 5). In his work on *Business Cycles* (1939), Schumpeter argued that the process of innovation, with its cycle of creativity by entrepreneurs and diffusion to other firms, accounted for the uneven swings of recession and expansion in the capitalist economy. For Schumpeter, innovation was the essence of the capitalist process. Clustering unevenly over time, innovation was an historically created phenomenon in which the essence of the entrepreneur and the entrepreneurial function emerges from historical investigation (Schumpeter, 1949: 55). The preoccupation with historical analysis was an ongoing theme throughout all of his later work (Lazonick, 1990; 1994). In summing up his approach to the economic process, Schumpeter writes that “the subject of economics is essentially a unique process in historic time.” He goes on to argue that nobody can hope to understand economic phenomena “who has not an adequate command of historical *facts* and an adequate amount of historical *sense* or of what may be

described as historical *experience*” (Schumpeter, 1954: 12). It was this integration of history that distinguished Schumpeter’s approach to innovation and the process of economic development.

### **Schumpeter and the Legacy of Marx**

While Schumpeter’s work on innovation is highly original, it derives much of its influence from Karl Marx. Four themes stand out in Schumpeter’s theory of innovation and economic growth that reveal this influence. These themes include: 1) the decisive role of technology in capitalist development, 2) the disruptive and revolutionizing tendencies of technological change, 3) the crisis-prone character of capitalism, and 4) the historical character of technology and the economy. Schumpeter himself critically acknowledged this legacy of “Marx the Economist” in framing his own fundamentally historical theory of innovation (Schumpeter, 1942: 21-44).<sup>1</sup> Aspects of Marx’s work are therefore a logical starting point for profiling Schumpeter’s views on innovation and development.

Marx, in Schumpeter’s view, was the first of the classical economists to recognize the role of technological dynamism in the development of capitalism, and the first to understand the role of history in influencing both technological change and economic development. Much like Schumpeter drew upon the neoclassical work of Leon Walras to reveal how equilibrium models of commodity flows did not represent the historical process of economic development, Marx drew upon the classical economists, primarily Smith and Ricardo, in critiquing the absence of history in the economic orthodoxy of his own day. “Economists explain to us the process of production under given conditions;” Marx writes, and goes

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<sup>1</sup>Examples from the opening chapters of *Capitalism, Socialism and Democracy* emphasize this point. Writing about technological “progress” in capitalist society, Schumpeter observes that “Marx saw this process of industrial change more clearly and he realized its pivotal importance more fully than any other economist of his time” (Schumpeter 1942: 32). As for the sources of his own historical approach to innovation, Schumpeter writes of Marx: “He was the first economist of top rank to see and to teach systematically how economic theory may be turned into historical analysis and how the historical narrative may be turned into *histoire raisonnee*” (Schumpeter, 1942: 44). Such passages contrast with the often-static contemporary discussions of whether Marx was “right” in his analysis of capitalism’s attributes and tendencies. For Schumpeter, the picture of Marx was complex, resonating with both success and shortcomings. The literature on the impact of Marx on Schumpeter is vast but see especially the work of Lazonick (1991; 1991b; 1994) and Catephores (1994).

on to explain that “what they do not explain is how these conditions themselves are produced, that is, the historical movement that brings them into being” (Marx, 1847: 199).

According to Marx, capitalism leads to an immense expansion in productivity because the system of private property rights together with market competition, creates historically-unique institutions that generate powerful incentives on firms to innovate and accelerate the process of technological change (Marx, 1848; Rosenberg, 1982: 8). These institutions of private property along with competitive markets, and the incentives they established, make the capitalist class the first ruling class in history whose interests are linked not to maintaining the status quo, but instead are dependent on overturning it by developing new technologies as a source of profit and accumulation. In anticipating the now-celebrated passage of Schumpeter on creative destruction, as well as providing prescient insights about the current period, Marx observes that: “The bourgeoisie cannot exist without constantly revolutionizing the instruments of production,” and goes on to write: “Constant revolutionizing of production, uninterrupted disturbance of all social conditions, everlasting uncertainty and agitation distinguish the bourgeois epoch from all earlier ones. All fixed, fast-frozen relations...are swept away, all new-formed ones become antiquated before they can ossify. All that is solid melts into air,...” (Marx, 1848: 111). This view of the capitalist process as one of incessant innovation and disruption stemming from new technology had an unmistakable influence on Schumpeter.

Marx employed a fundamentally historical method in accounting for new technologies. He ascribed the catalyst for technological change to growing markets beginning in the sixteenth century. Such widened markets provided the environment in which firms could exploit new technologies as a source of profit and accumulation. In this way, Marx was decidedly *not* a technological determinist (Rosenberg, 1982: 36-38).<sup>2</sup> Far from assigning technology an autonomous role as an independent variable in transforming the economy, Marx attributed changes in technology to the enlarged horizon of possibilities for profit created by ever-growing markets as the economy evolved from early manufacture

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<sup>2</sup>Rosenberg’s account is a compelling refutation of Marx as a technological determinist.

to modern industry (Marx, 1848). Once established as historical outcomes, however, new technologies emerge in Marx as a central element in the process of capitalist development. The conflicts between technology as a productive force, and the social relations of production in terms of ownership and control over technology and the surpluses generated from it, are, for Marx, what drive the process of economic development. Technology plays a critical role in this rhythm of development but it is not some ineluctable force. Capitalists make choices to innovate in order to compete more effectively.

Nevertheless, Marx acknowledged that as technology changed in conjunction with market expansion, so too did business enterprise. He had a theory of firm concentration in which competition, innovation, the cheapening of commodities, and the scale economies of large enterprise evolved in an evolutionary way. What Marx understood as the tendency of technology to develop alongside the enlargement of the capitalist firm, however, Schumpeter took one step farther in equating the phenomenon of innovation with oligopoly. In Marx, capitalist development, technological change, and transformations in the size and organizational structure of business establishments were all part of the same historically driven process. A similar story would be told by Schumpeter -- but one that also had important differences.

### **Innovation and Entrepreneurialism**

While Schumpeter accepted in broad outline these key elements from Marx in creating his theory of economic development, he added a critical idea about the process of innovation that separated him from Marx -- the idea of *entrepreneurialism*.<sup>3</sup> In addition, Schumpeter also distinguished different phases comprising the innovation process itself. According to Schumpeter, innovation consists of three distinct

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<sup>3</sup>In developing his idea on entrepreneurialism, Schumpeter also discarded two other key concepts in Marx. Firstly, Schumpeter did not accept Marx's emphasis on dialectics in history. Secondly, Schumpeter rejected Marx's view that class conflict was the motive force in history and economic development. As a consequence, Schumpeter argued that capitalists did not achieve a preeminent position in the economy by exploiting the working class. On the contrary, he argued that the driver of capitalist society consisted of capitalists competing and stomping all over themselves. Interestingly Robert Brenner, in a recent analysis of the world economy written from a Marxist perspective, argues similar to Schumpeter, that the logic of competition – the horizontal relationships between capitalist firms – not class struggle, rules the rhythms of growth and recession (Brenner, 1998).

moments -- initial *invention* of new products, processes, organizations, and markets, *commercialization* of these elements, and finally *diffusion* of these elements to other firms. In conceiving of innovation as a series of historically conditioned moments, Schumpeter was interested firstly in differentiating the behavior of firms at each of the three phases. Secondly, he was particularly intent on tracing how the responses of entrepreneurial firms to the profit-making environment resulted in new business routines that challenged existing business practice, diffused to other firms, and transformed the entire economic system.<sup>4</sup> For Schumpeter, innovation was both artifact and impact.

Central to Schumpeter's theory of economic development is the *creative* act of entrepreneurs in commercializing new technology and in the process launching innovation (Schumpeter, 1947). It was only an act of entrepreneurship that enabled technical inventions to emerge from obscurity and assume the role of commercial artifacts (Freeman, 1991: 304). Schumpeter, however, defined this process of innovation broadly. He conceived of innovation as “the carrying out of new combinations” corresponding to the new products, new methods of production and distribution, new forms of business enterprise, and new markets associated by Schumpeter with technological change (Schumpeter, 1911; Schumpeter, 1942). Entrepreneurialism acts as a disruptive force in the economy, challenging the competitive strategies and behavior of existing firms. The relatively short bursts of technological creativity by entrepreneurs, however, engender longer periods of assimilation and adaptation marked by imitation and complementary types of innovation by firms. This process of diffusion has profound consequences for the economy as a whole. It completes the pathway of creative destruction along which are the new products, new operational routines, new forms of business enterprise and new markets where firms seek profit.

Schumpeter observed how new technological combinations marking the process of creative destruction were distributed unevenly throughout the history of capitalism. Such combinations tended to cluster in “swarms” that marked the beginning of the growth cycle (Schumpeter, 1911: 223). As the

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<sup>4</sup>Schumpeter did concede, however, that the entrepreneurial function and the process of economic change still required more detailed investigation in order to understand “the actual working of capitalism that we are but dimly perceiving as yet” (Schumpeter, 1947: 156).

economy moves outward along a new production function owing to the growth impacts of new technology, the economic rents accruing to entrepreneurial firms that give rise to the growth process, are eventually competed away as firms imitate and adapt to new innovation. This leveling of profit rates then paves the way for downturn and depression. Far from repeating, however, these business cycles redefine the context for the next round of innovation, expansion and contraction.

From this notion of business cycles and technological clusters, Schumpeter arrived at a long-term view of capitalist development punctuated by distinct industrial revolutions separated in time.<sup>5</sup> He dates the first industrial revolution from the 1780s-1842. The second occurs from 1842-1897 while the third begins in 1898 and corresponds to Schumpeter's own time. Although time-specific, these revolutions share common features of transformation that act as drivers of the capitalist process. Schumpeter actually references a key aspect of the nineteenth-century communications revolution in coining the term “railroadization” to describe the pattern of economic change associated with these features (Schumpeter, 1939: 304, 325-351, 72-192; Andersen, 1994: 26-62).

In focusing on the railroads to illustrate his theory of economic change, Schumpeter builds a model starting with an equilibrated system of competitive strategies, routines, business organizations, and markets that is “disturbed” by the innovation of railway-based transport networks.<sup>6</sup> This innovation in the transport and communications sector of the economy provokes responses by business users of this infrastructure. Entrepreneurial firms among these users develop strategies, routines, and forms of enterprise that challenge the products, processes, organizations, and markets of other firms. What these entrepreneurial firms create from their innovations is a new cost and pricing structure for economic

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<sup>5</sup>Schumpeter acknowledged that the idea of innovation cycles or “waves of innovation” had come from previous theorists, notably Kondratief, Juglar and Kitchin (Schumpeter, 1939; Hall and Preston, 1988). Schumpeter's theory has produced a separate debate on the timing and duration of long waves. Within this debate, however, Perez argues that Schumpeter's work does not actually provide a basis for long waves. She insists that Schumpeter's theory is instead an account of the short-term cyclical movement of recession and recovery exhibited by the capitalist economy (Perez, 1983: 359).

<sup>6</sup>The idea of an economy in equilibrium may appear paradoxical in Schumpeter's work since he aimed to distance his historical and evolutionary approach to the economy from neoclassical notions of equilibrium. Schumpeter explains however, that his use of equilibrium is an analytical tool from which to launch his notion of technological disturbance.

activity, and more importantly, new activity itself. These changes in costs, prices, and types of economic activity are the basis of what Schumpeter described as “new production functions” in the economy. In order to compete, other firms adapt to the innovative activity of entrepreneurs and the production functions they establish. What results from these innovative and adaptive activities is a broader process of economic transformation.

Schumpeter, however, was far from a technological determinist. He conceded that entrepreneurialism in the railway sector, which ignited such broad based changes in the late 19<sup>th</sup>-century economy, had a *political* edge. The leadership within particular groups of rail builders, and the relationship of these groups to local, state, and national political figures, played essential roles in promoting the viability of the railroad as a profit-making venture. These alliances between rail entrepreneurs and their political backers are what secured for rail builders the land and the rights of way necessary for rail building to occur in the first place. According to Schumpeter, such relationships were not only critical in promoting railroad development. Railroad entrepreneurialism tied to politics is what enabled the railroad to act as a catalyst for economic development. As railroads expanded, they triggered a range of innovations in other sectors of the economy as business firms came to understand the profit opportunities of involvement in business activities supported by government.<sup>7</sup> As a consequence, new industries emerged -- steelmaking -- while others such as mail coaches became extinct. Furthermore, railroads, supported by government homesteading, promoted economic development in regions of road building ahead of population (Schumpeter, 1939: 327-330). In effect, individuals and firms visualizing the financial gains of railroad technology was an insufficient condition for launching the new infrastructure. The process of railroadization for Schumpeter was an entrepreneurial as well as political phenomenon.

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<sup>7</sup>While Schumpeter concedes that innovation during the second industrial revolution at the end of the nineteenth century was essentially an outcome of rail development, he is careful to point out that the innovations in industrial processes “were not mere adaptations to the conditions created by the Roads” (Schumpeter, 1939: 383). Industrial innovation in the U.S. he notes, -- especially efficient labor saving machinery -- had earlier antecedents that converged with the opportunities presented by rail to produce the unique character of American industrial evolution in the late 19th century.

Initially, Schumpeter interpreted innovation to be an entrepreneurial function of individuals (Schumpeter, 1911; Freeman, 1994). Later, Schumpeter conceded that the entrepreneurial function had become increasingly socialized within the large capitalist enterprise. From the vantage of the mid-20th century, it was these firms that created the new products, processes, organizations, and markets of capitalist development. His “creative destruction” was a process occurring *within* these enterprises. The question still largely unanswered in Schumpeter, however, focused on what was actually occurring inside these enterprises to promote the innovation process.

### **Innovation as Learning**

What Schumpeter conceded to be this still dimly perceived problem inside the firm emerged in a somewhat more illuminated form several years later with the revelation that the innovation process is essentially a learning process (O’Sullivan, 2000: 407). In many ways, the inspiration for this now-commonly accepted connection between innovation and learning derives from the work of Edith Penrose who sought in this link the sources of growth within the firm and the economy. For Penrose, growth revealed an evolutionary process at the core of which was the cumulative expansion of knowledge within the business enterprise (Penrose, 1995: xii). As a collection of human and material resources bound within an administrative framework, the firm promotes growth by learning to transform these resources into new profit-making activities, that is, new products, processes and even new ways of manipulating the market environment to serve its interests (Penrose, 1995: xiii). Growth occurs when new knowledge is added to this base of resources, and the firm subsequently provides the market with new goods and services in fundamentally new ways. In accounting for the so-called “residual” in the growth process, that is, the increment of expansion not attributable to increases in production factors, Penrose uncovered in the learning process one of growth’s critical missing links. In this way, growth, much like the growth concept of Schumpeter, is generated from *within* the enterprise with knowledge leading to innovation acting as the catalytic agent for such transformation.

These insights of Penrose have spawned a more recent literature on innovation focusing on how

firms learn, and how firms *act* when they acquire new knowledge (Rosenberg, 1982; Nelson and Winter, 1982; Lamoreaux et al., 1999; Dosi, 1997; Dosi et al., 1998). The theoretical and empirical problem explored in this literature is how firms, in learning about opportunities for generating profit differently in a given market environment, transform such knowledge into new *capabilities*. How, in effect, does the firm evolve into what has been described as the “innovative enterprise” (Lazonick, 1994; 2002).

One of the most influential routes used to explain this evolution of the enterprise begins with the firm as an entity motivated by profit and engaged in a learning process to enhance its capabilities within historically conditioned market environments. Such environments where this learning occurs, termed the technological “regime” (Nelson and Winter, 1982), or the technological “paradigm” (Dosi, 1982; 1984), or the “techno-economic paradigm” (Perez, 1983), share similarities with Schumpeter's technologically-based industrial revolutions that create periods of capitalist development. These environments establish general conditions for both profit-making and the learning capacity of firms based upon the past achievements and existing capabilities of market agents. At the same time, these environments leave open and contingent various forms of technological novelty and learning from one moment to the next (Dosi, 1997: 1531). At any given time, firms in these environments possess a specific set of capabilities. They either learn to modify these capabilities in order to accumulate profit more effectively and grow, or they fail to learn, become uncompetitive, and are driven out of business (Nelson and Winter, 1982: 4).

The fundamental mechanism in this learning process leading to transformation in capabilities and economic growth and development is the *search* by firms for more efficient and more profitable economic *routines*, and the selection of successful routines by other market actors.<sup>8</sup> This notion of the routine, however, is conceived broadly. It comprises the myriad operational, organizational, and strategic elements of what is often described as “getting things done” or more simply, the “technology” of the firm. Modifying capabilities through learning changes routines and is the essence of the innovative process. As this process of search and selection of routines gains momentum and becomes generalized, the economy

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<sup>8</sup>That this process of search and selection in the work of Nelson and Winter bears striking resemblance to Schumpeter's notion of innovation and diffusion is no accident. “The influence of Schumpeter is so pervasive in our work that it requires particular mention” (Nelson and Winter, 1982: 39)

evolves and there is transition from one historically-periodized industrial revolution to another. Consequently, the route from learning within individual firms, to the development of innovative capabilities throughout a generalized population of firms, occurs as part of an historical transformation.

Organizational learning involves an *investment* by the firm in reorganizing its resources the outcome of which is uncertain (O'Sullivan, 2000: 407). Firms that commit to learning and enhancing capabilities confront the uncertainty of having to forgo a measure of both the use and exchange value of these resources as they are redeployed as part of learning process. This uncertainty is of two varieties: productive uncertainty and competitive uncertainty (O'Sullivan, 2000: 407). Productive uncertainty exists for firms committed to learning because such firms have to figure out how to develop the productive capabilities of the resources in which they have invested before these resources can generate profitable returns. Competitive uncertainty exists because even if a business successfully develops a new product or better process, it may not be superior to that of a competitor pursuing an alternative approach.

Efforts by firms to overcome these uncertainties involve a process of visualizing outcomes from capabilities modified through learning. Firms visualize such outcomes and learn in a variety of ways (Pavitt, 1992: 220-221; Dosi, 1997: 1532). They learn by doing, that is, they learn from direct experience and experimentation with new products, processes and entries into new markets in a process encompassing much trial and error; they learn from competitors along with numerous other business actors such as their own suppliers; they learn from other organizations and institutions such as universities and government; and finally they learn from unsuccessful or incomplete efforts at solving problems and even by failing at such attempts. Nevertheless, firms seldom understand fully the exact trajectory of where the learning process will take them. As Schumpeter himself acknowledged, innovation is often the outcome of action taken without a complete understanding of what results will follow (see O'Sullivan, 2000: 407-409). In solving one problem to enhance capabilities, firms normally encounter additional problems unforeseen at the time when the learning process begins. For this reason, firms in the course of learning, are often compelled to solve what emerge as contingent problems that arise only after certain other difficulties have been overcome.

What differentiates firms is the degree to which they are able to coordinate deployment of their resources in pursuit of creating new capabilities (Lazonick and Mass, 1995: xv). This process of organizational “coherence” or “integration” is central to the literature on innovation. How is it that some firms succeed in this project and become innovative, while others are less capable of achieving such coherence? The key to solving this puzzle begins with the basic nature of the firm -- a profit seeking collection of resources organized within an administrative framework -- and its relationship to the profit environment in which it operates. Firms are agents that engage in a process of technological and organizational search in pursuit of opportunities to accumulate and secure profit (Penrose, 1995; Dosi, 1997: 1531). The fact that firms, through their own agency, can secure access to new knowledge, is what provides firms with opportunities for enhancing their capabilities. In this search, firms make choices with regard to ways of getting things done but their selections do not derive from some omniscient understanding of the most profit-optimizing pathway available in the market as assumed in rational choice models of human action. Firms seek solutions to problems and select alternatives for competing on the basis of imperfect knowledge about profit opportunities and an incomplete picture of the technological solutions available for pursuing these opportunities (Dosi, 1997: 1531-32; Lamoreaux et al., 1999: 6-8).<sup>9</sup> This imperfect knowledge gives rise to variation in the choices firms are likely to make regarding strategy, routines, and organization and thus in their capabilities. While business firms exist in the same world, they see the world differently, and they learn different things from the same world. As a result, they make choices that are not programmable, but instead are highly contingent (Metcalf: 1998: 35).

At the same time, the selection by firms of competitive strategies, operational routines, and forms of business organization is not random. Because firms compete in historically conditioned environments, they make choices from a range of options that derive from such environments. Thus, while the parameters for the choices of firms are historically created, firms exercise agency in making their

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<sup>9</sup>These notions of “imperfect” knowledge and “incomplete” understanding in no way imply that there exists in reality some state of perfect information to which firms aspire. Such a state only exists as one of the many assumptions of the economic world in neoclassical economics.

selections (Yates, 1997).<sup>10</sup> These choices drive the economic development process (Nelson, 1998: 322). They not only provide the basis for innovation in the economy. They are the mechanism by which the innovation process diffuses, spreads and transforms patterns of economic development.

### **Innovation as Inducement**

While the literature on innovation as learning provides a descriptive route from the micro-activity in the firm, to the increasing returns generated from new capabilities, it is less precise in specifying what in the market process is providing the catalyst for acquisition of new knowledge. Here, as Dosi insists, there is a valuable link to be made with the growth literature on *inducements* to innovation (Dosi, 1997). From this perspective, innovation results from the responses of firms to specific transformations in the market environment. Changes in market demand, factor prices, even new technologies act as inducements on firms to accumulate profit from the environment in new ways. As a consequence firms, in seeking the profit opportunities from different circumstances, learn new things and alter the supply of knowledge in the economy. The outcome of such collective organizational learning is innovation and growth.<sup>11</sup>

Inducements to growth and innovation, however, are not necessarily limited to changes in demand, prices, or technology. Inducements -- as well as constraints -- to innovation may also exist outside the formal boundaries of the market within the realm of politics and institutional settings (Zysman, 1994; John, 1998). From this perspective, innovation is more than a process of knowledge acquisition by firms in an effort to alter routines for accumulating profit. Innovation involves the

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<sup>10</sup>This interplay of structure and agency is the central idea in the *Structuration* theory of Giddens. He argues that historically-conditioned environments shape -- not determine -- human action which in turn, reconstitutes those environments (Giddens, 1984; Yates, 1997: 161). The classic formulation of this idea comes from Marx who observed that human beings "make their own history but they do not make it exactly as they please. They make it from circumstances that are given and transmitted from the past" (Marx, 1851).

<sup>11</sup>Changes in the environment, however do not mechanically produce innovation. Quoting the historian of medieval technology, Lynn White, on the impact of new technologies on the process of technological innovation, David Hounshell points out "that a new device merely opens a door; it does not compel one to enter" (White, quoted in Hounshell, 1995: 210).

interaction of the innovator with systems of economic rulemaking established through politics, and structures of power related to conflict and consent among groups and classes. Innovation, in effect, has two components: an epistemological component involving the struggle between the mind and nature; and a social and political component involving institutions and the power struggles within society that shape technological outcomes (Mokyr, 1990: 11). According to its defenders, this second dimension of innovation has been subordinated to the perspective on innovation as learning (Hughes, 1983: x). Two closely related approaches to technological change, namely “contextualism” (Hughes, 1983), and “social construction” (Bijker et al., 1989) seek to remedy this omission.<sup>12</sup> The model of innovative advance found in the synthesis of these two approaches borrows certain features from Schumpeter, namely the ideas of invention, and diffusion (called “transfer” in the social construction literature). To these two concepts however, Hughes and Bijker et al. add the notions of “reverse salients” and “momentum.” From Hughes, reverse salients refer to critical technical problems where the line of innovative advance encounters bottlenecks in the form of knowledge gaps that if left unresolved, preclude innovation (Hughes, 1983: 14-17). For social constructivists, reverse salients refer also to constraints on innovation emerging within the social and political environment ranging from opponents of technological change, to rulemaking environments that create legal barriers to change. Critical to this group of theorists is the *actor network*, the medium through which individuals, groups, and classes interact and struggle with each other and through institutions to shape innovative outcomes according to their interests. Momentum refers to the phase in the innovation process when the problems of reverse salients are confronted and resolved enabling innovation to strengthen. Central to this phase is the resolution of power struggles within actor networks, the outcome of which enables certain actors with certain technological interests to prevail. Winners can choose to promote, thwart, or redirect the trajectory of innovation. Actors that prevail in these contests for power use the rulemaking authority of politics and institutions to legitimize

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<sup>12</sup>Although Hughes is typically categorized as a social constructionist, his approach reveals certain subtle differences which he acknowledges in locating his views “somewhere between the poles of technological determinism and social constructivism” (quoted in Hounshell, 1995: 215).

the chosen technological pathway corresponding to their interests. What is critical from this approach is that innovation is a contingent process shaped by choices, politics, and power.<sup>13</sup>

With similar concerns, but with more of an emphasis on history, is a group of scholars who critique the idea of innovation as an outcome of the search for *efficiency* (Berk, 1994; Roy, 1997; John, 1997; Sabel and Zeitlin, 1985). Far more central than “the logic of efficiency” in understanding innovative outcomes is the role of politics, institutions, and relations of power. Equating innovation with efficiency, they argue, is akin to an *ex post*, teleological vision of the innovative process that suffers from what they insist is technological determinism. Moreover, such arguments about innovation cast in the logic of efficiency are, they contend, fundamentally restatements of neo-classical economic models. Innovation in these models is the result of efficient allocative outcomes. This overly determined, teleological vision of the neoclassical marketplace, they insist, has been overlayed upon the historical process and much like neoclassical models, omits any real role for institutions and politics in human activity.<sup>14</sup>

Also related to concerns with contingency and context is the idea of inducements to innovation that derive specifically from the relationship of workers to management and relations of power between them. In this context, management, in seeking greater levels of control over the work process, searches for new technologies that empower managers with enhanced capabilities to reorganize work with less resistance from workers. From this perspective, innovation is induced by class conflict and is the result of

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<sup>13</sup>Within this context of reverse salients and momentum, *standards* and dominant designs play both a technical and social role in influencing the pathway of innovation. From a technical perspective, when standards or designs for certain products and processes become dominant and force other products and processes in the economy to adapt in order to function, such standards or designs can both determine and constrain innovation. In this context, pathways for innovative advance are already established owing to the difficulties of moving so many interdependent economic activities already functioning on the basis of the dominant standard or design to an alternative technological path. Certain standards or designs that become so thoroughly embedded in the economy – the QWERTY keyboard is the most well-known example but the Microsoft operating system is equally compelling – can preempt innovation along an alternative path. Standards and dominant designs are also sources of social and political struggles within actor networks -- “standards wars” – because of the high stakes in control over dominant technologies. On dominant design see Utterback and Suarez (1993) and Henderson and Clark (1990) while on the process of standard setting see David and Greenstein (1990) and David (1987).

<sup>14</sup>Much of this critique, however, is directed at the work of one individual in particular, Alfred Chandler, discussed in more detail below.

ongoing efforts by management to gain greater levels of control over workers and work (Marglin, 1974; Noble, 1984).

Finally, if conditions in the environment are what induce firms to learn and expand capabilities, then one of the most critical inducements to learning are the external economies and network-like interactive relationships of firms in so-called “milieux of innovation” or “learning regions.” Inspired by the insights of Alfred Marshall, this view of the innovation process derives from the observation that innovation tends to concentrate geographically in certain regional economies. In these place-based concentrations of economic activity emerge the interactive network relationships within and between firms that provide firms with the external scale economies -- Marshall’s “mysteries in the air”-- from which firms learn and innovate, and from which regions become differentiated (Saxenian, 1994).<sup>15</sup> In this way, changes in the economic environment, and conditions of concentration in the environment, induce the process of learning within firms. The innovative enterprises that, by definition, are the agents of this growth process are also, it turns out, transformed by it and assume identities as new business organizations.

### **The Firm as Business Organization**

Business firms create forms of organization in the course of seeking profit. As firms learn about new ways to accumulate, they not only transform their routines for producing, buying, and selling. They adapt their organizational structure to these new routines. In this way, organizational transformation is an integral part of the innovative process. This relationship between innovation and organizational change has its origins in Marx and Marshall. It also has a more recent lineage.

In the late 1920s, economist Allyn Young observed that the marketplace consists essentially of “productive activities tied together by trade” (Young, 1928: 533). He used this characterization as a

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<sup>15</sup>Saxenian emphasizes, however, that proximity alone among firms is insufficient as an enabler of innovativeness and competitiveness. Instead, place-based concentrations of economic activity must have other attributes that together create an innovative *industrial system* (Saxenian, 1994: 6-7). Nevertheless, for Saxenian, it is *place*, built from unique local histories, culture, and institutions, that differentiates industrial systems providing the source of innovative learning.

starting point to uncover how the relationship between the market, the division of labor, and innovative methods of production lead to increasing returns and economic growth. His aim in revealing the outcome of this relationship was twofold. Firstly, he wanted to demonstrate why forces counter to economic equilibrium “are more pervasive and more deeply rooted in the economic system” than is commonly realized (Young, 1928: 533). Secondly, Young was determined to show how external economies, deriving from the extent of the market and the division of labor, provided the source for innovation or what Young metaphorically termed “roundabout” methods of production. In this effort, he not only drew upon the seminal insight of Adam Smith linking growth to the interplay of the market and the division of labor. Young seized upon the observation made by Marshall of the business firm as a unit of organizational change, and used this characterization to argue that innovation and economic progress derived from the capacity of firms to evolve in conjunction with changes in the market environment. What emerges from Young’s synthesis of Smith and Marshall is a marketplace of business firms evolving in organizational structure as they seek roundabout methods for producing and trading in an effort to generate increasing returns.

While Young’s article provided a dynamic, even evolutionary view of economic development, his approach focused more on the aggregate economy than the business activity of *individual firms* (Lazonick 1991: 294-295). It was Ronald Coase (1937) who, in a highly original article written roughly ten years later, asked a fundamental question about the nature of the firm that provided a critical theoretical insight on firms as forms of business organization. The issue that interested Coase was why, and under what circumstances a firm would choose either to produce on its own, or purchase a given input in creating a product or service. “To make or to buy” was the essence of this choice. As a practical matter, firms in exercising this choice, decide on the extent to which they internalize adjacent steps of producing, buying, and selling, and the extent to which they contract with other firms in undertaking these activities. Such decisions situate firms along a continuum marked by two basic types of business organization: *intra*firm networks in which the firm is highly integrated, and *inter*firm networks marked by cooperation and relationships among separate firms. What Coase sought to uncover was the source of the governance

structure of these two types of organization -- whether through markets or through administrative coordination -- and the boundaries of these organizations resulting from the chosen form of governance.

### **Integrated Firms, *Intrafirm* Networks**

As a starting point in addressing this puzzle of organization, Coase imagined an economy “under no central control” but unlike Young, focused his analysis on the individual firm in seeking to identify how the functions performed by firms are divided up among and between them (Coase, 1937). This issue led Coase to pose three basic questions: When do firms produce for themselves internally, and when do firms purchase from other firms? What types of economic organization derive from these decisions to make or buy? and what determines which activities a firm chooses to do for itself, and which it procures from others? These questions, in turn, led Coase to address the puzzle of why, when there is a price mechanism for securing all goods and services in a specialized exchange economy, there should be any economic organization at all (Coase, 1937: 388).

In order to solve this problem, Coase observed that the economy, although absent a central control, is only partially coordinated by the price mechanism. Firms employ a different organizing principle in which “conscious power” or *planning* is used to allocate resources. “If a workman moves from department Y to department X,” argues, Coase, “he does not go because of a change in relative prices, but because he is ordered to do so” (Coase, 1937: 387). Coase equates this power of planning to “entrepreneurs” and distinguishes their activity of coordinating the operations of the firm internally, from the activities of firms transacting through the price system. In the economy, he observes, “price movements direct production which is coordinated through a series of exchange transactions on the market.” In the firm, by contrast, “these market transactions are eliminated and in place of the complicated market structure...is substituted the entrepreneur co-ordinator, who directs production” (Coase, 1937: 388). For Coase, internalizing these transactions within the firm, and transacting in the

market with other firms through the price system for the same goods and services, are the two alternative methods for coordinating economic activity (Coase, 1937: 387-389).

For the answer to his central question of why there are firms, Coase proposed that there are costs to firms -- transaction costs -- of using the market and the price system to exchange goods and services. When the costs of coordinating transactions internally are less than the costs of using the market and the price system to transact for these items, the firm absorbs the activities represented by these transactions into its own organizational structure. As a consequence, the firm becomes more integrated, and less reliant on the marketplace to secure the items needed to create a product or service. For Coase, a firm has a role to play in the economy if “transactions [can] be organized within the firm at less cost than if the same transactions were carried out through the market.” Firm boundaries are also established through this same mechanism of choice deriving from the costs of transactions. The limit to the size of the firm is reached “when the costs of organizing additional transactions within the firm exceed the costs of carrying out the same transactions through the market” (Coase, 1991: 48). Managers of firms, he claimed, are preoccupied with the single overriding concern of transaction costs in calculating the trade-offs of using the market, or absorbing production and trade activities internally (Coase, 1937: 404).<sup>16</sup>

This singular focus with transaction costs, however, compelled Coase to ignore other critically important aspects of business organization. Coase rejected a role for technology on the organization of the firm (Williamson, 1987: 4). Coase also did not view politics, or contingencies in the historical process itself, as influential on the organization of the firm. His model is abstract and ultimately ahistorical (Lazonick, 1991: 195). Nevertheless, despite these omissions Coase, in this article, produced a seminal work with an enduring legacy. In posing basic questions about the structure of enterprise, Coase

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<sup>16</sup>Despite this seemingly one-sided emphasis on the nature and boundaries of business firms, Coase was not without insights on the spatial dimensions of organization. “Inventions which tend to bring factors of production nearer together by lessening spatial distribution, he writes, “tend to increase the size of the firm. Changes like the telephone and the telegraph which tend to reduce the costs of organizing spatially will tend to increase the size of the firm” (Coase, 1937: 397).

provided a theoretical starting point to account for the organizational variation in firms. He found in transaction costs a compelling, if one-sided explanation for why firms were vertically-integrated, or why they operated within interfirm networks and transacted across markets.

Coase's pathbreaking approach to the boundaries of the firm inspired a group of influential economists from the so-called behavioral school, most notably Oliver Williamson. Starting from Coase's dichotomy of the way firms either internalize transactions, or transact through the market, Williamson used transaction costs to account for firms as representative of "Markets and Hierarchies" (1975). Market-oriented firms were those that used the marketplace to transact with other firms for inputs to make goods or provide services. These firms would also transact with other firms to distribute and sell their products and services. Hierarchies, by contrast, were those firms that assumed ownership over the input activities, the productive activities, and the marketing activities in creating and selling a product or service. Hierarchies, in effect, assume ownership and control over large portions of procurement, production and distribution, and are the equivalent of Coase's directing "entrepreneur." What Williamson did that differed significantly from Coase, however, was twofold.

Firstly, unlike Coase, Williamson proposed that transactions, and transaction costs exist not only in market exchange but are also as part of the operations internal to the firm. In effect, transactions for Williamson exist between firms across markets, and within firms. Costs of transactions result from uncertainty in exchange which has three essential origins: 1) the self-interested guile or opportunism of other parties to the transaction; 2) incomplete information or *bounded rationality* regarding the parameters of the transaction; and 3) control over *assets specific* to a transaction. The choices of firms to transact through the market or internalize transactions activities derive from the efforts of firms to minimize the costs of these uncertainties. According to Williamson, minimization of the costs of uncertainty related to opportunism and bounded rationality, suggests organization of transactions through markets. By contrast, minimization of the costs of uncertainty related to being without assets necessary

for a certain type of transaction compels firms to remedy such problems through organization into hierarchies. It is, in fact, asset specificity upon which his predictive theory of organization hinges (Lazonick, 2002: 11). Specifically, Williamson hypothesizes that “market contracting gives way to bilateral contracting which in turn is supplanted by unified contracting [hierarchical organization] as asset specificity progressively deepens” (Williamson, 1985: 78; see also Lazonick, 2002: 11).

Secondly Williamson, unlike Coase, aimed at testing his approach to transactions costs and organization in actual historical situations. He was especially interested in the formation of corporate hierarchies and the process of vertical integration in the U.S. during the late nineteenth century. In this sense, Williamson’s interest in history aligned his work closely with the approach taken by Alfred Chandler. Nevertheless there is at least one fundamental difference between the transactions-cost approach to firm structure elaborated by Williamson, and the “Strategy and Structure” approach to the organization of the firm pioneered by Chandler. This difference focuses on the issue of the relationship between innovation and organization. As Williamson concedes, the introduction of innovation complicates the assignment of transactions to markets and hierarchies (Williamson, 1985: 143; see also Lazonick, 2002: 13). It was Chandler who would more systematically make this connection between innovation and technology on the one hand, and business organization on the other.

For Chandler, the *strategy* of the firm, deriving from an “awareness of needs and opportunities created by a changing economic environment,” fundamentally influenced the *structure* of the firm defined as the “design of organization through which the enterprise is administered (Chandler, 1962: 14-14).<sup>17</sup> Beginning in the second half of the nineteenth century, the appearance of the vertically integrated enterprise reflected new strategies developed by management to produce and market goods in high volume. Through such strategic and organizational adaptations, management created what Chandler describes as “economies of speed” in an effort to achieve high-volume throughput. It was the ongoing efforts of firms to master economies of speed and high-volume production and marketing that account for

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<sup>17</sup> Chandler points out, however, that strategies could be carried out through different forms of organization, although he insisted that the integrated corporation prevailed because it was the most efficient.

the tendency of vertical integration to assume a dominant role in the organizational structure of late nineteenth century business enterprise (Chandler, 1977).

According to Chandler, there were good reasons for the link between the size of the firm, the volume of throughput, and the speed at which goods were produced and sold. Faster, high-volume throughput hinged on uninterrupted sources of supply, and unimpeded sales of finished goods. Such requirements implied that functions once mediated by different firms using the market mechanism, began to accumulate within the boundaries of a single firm using the “Visible Hand” of management (Chandler, 1977). This form of administrative planning provided better forms of coordination between inputs and output. In addition, the need for management to secure more predictable sales outlets for high volume throughput, coupled with antiquated distributions systems, pushed numerous firms into marketing activities and forward integration. In this way, the strategy of the firm became linked to organizational structure through innovation that transformed production and distribution.<sup>18</sup>

In the view of Chandler, rail and telegraph technologies figured prominently into the emergence and development of this new business institution (see “Communications Revolution” below). The rail and telegraph system helped integrate formerly isolated localized markets into a geographically-extended national market while at the same time concentrating market demand in cities. This market structure, in turn, created a new set of strategic opportunities for the firm. In the wake of more extended markets and mass markets in cities, producers had incentives to expand volumes in order to service this more-extended and concentrated national market space. Rails and telegraphy furnished producers with the reliability and speed necessary to coordinate flows of supplies and finished goods long distances, as well as in and from urban factories in sufficiently high volumes to service this new market structure. As a consequence, firms

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<sup>18</sup>It was only in the aftermath of completing *The Visible Hand* that Chandler took an interest in Williamson’s work on transaction costs and its implications for his own emphasis on strategy and structure (see Chandler, 1988). Chandler conceded the possibility that coordination of supplies, production, and marketing within the boundaries of the firm also resulted in lower transaction costs for the large corporate organization. In the view of Chandler, however, reductions in transactions costs were more an *outcome* stemming from more efficient coordination than a cause for organizational change. For Chandler, it was economies of high volume throughput and economies of speed that created the basis for administrative control underlying the large integrated corporation, not costs of transactions.

became larger and assumed new capabilities to take advantage of scale economies in coordinating high-volume throughput. Business firms also integrated backward into raw material suppliers, and forward into marketing to sell their finished products. In Chandler's model, changes in technology and markets created a new strategic orientation for producers based on high volume throughput. Drawing upon Weber and Schumpeter, strategy became structure in the form of the vertically integrated administratively coordinated intrafirm business organization.

Chandler argued forcefully that the large corporation, coordinating its activity through internal administration rather than market transactions, was a more *efficient* form of business organization than the small-scale proprietary firm coordinating its activity through markets. Contrary to the claims of his critics, however, Chandler did not insist that the integrated corporation reflected an innately superior form of organization in economic life. His work seeks to explain the historical ascendancy of the vertically-integrated firm in the American economy during the period of 1870-1920. For Chandler, this form of enterprise emerged historically around a set of efficiency objectives -- economies of speed and economies of scale – that became realized through management control and vertical integration. It prevailed during the period for this economic reason.<sup>19</sup>

### ***Interfirm Organization***

Ironically, when Chandler's *Visible Hand* appeared in 1977, the large scale, vertically integrated corporation appeared to be suffering the first serious challenge to its hegemony as a profit-generating institution since its initial creation in the late nineteenth century. Beginning in the early 1970s, large

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<sup>19</sup>Chandler's critics notably Berk (1994), Roy (1997), Scranton (1997), and Sabel and Zeitlin (1985) make two basic counter claims to his argument. Firstly they are especially critical of Chandler's efficiency argument insisting that the account of Chandler suffers from technological determinism. Technology and efficiency, they argue, are insufficient explanations for the evolution of the large vertically integrated corporation. Secondly, because of this focus on technology and efficiency, Chandler (in the view of these scholars) neglects the political struggles at the center of industrialization, and is oblivious to the fact that the choices made by firms about technology, strategy and firm structure were *politically*, not economically motivated. These shortcomings preclude Chandler from recognizing the diversity of outcomes during the late nineteenth century in terms of firm structure, regionalism, and technologies. There seems little reason, however, why Chandler's argument emphasizing the primacy of technology and economics, is incompatible with the view that politics is critical to the way firms make choices about competing. For an excellent overview of this debate, see Hounshell (1995).

corporations in the industrial countries, especially in the U.S., exhibited a precipitous decline in profitability that continued into the 1980s (Harrison, 1994: 125-127). At the same time, a range of new firms, mostly from Japan but also from other countries in East Asia, emerged as serious competitors to these previously formidable corporate organizations. Interestingly, the economic challenge to corporate America represented by Japan came from firms that were seemingly even more highly integrated than American companies. In many ways, these Asian firms helped provoke this profit crisis by exposing the complacency and uncompetitive character of their once-dominant American counterparts. The Japanese *keiretsu* and the Korean *chaebol* were business organizations integrated both vertically and across sectors including finance (Gerlach, 1989; Amsden, 1989). Eschewing forms of market exchange, the keiretsu and the chaebol organized their business operations through tightly coordinated and highly administered relationships. In many ways, these organizations were the quintessential embodiment of the *Visible Hand*.

Nevertheless, a very different story of this challenge -- and one that has had a more enduring impact owing to the eventual slowdown and sustained malaise of the Japanese economy -- has emerged with a focus on a far different organizational phenomenon. In this interpretation, the role of the large firm in economic development was being undermined by examples of place-based growth and innovation deriving from clusters of medium-size and even small firms, notably in Italy, Germany, and the U.S. Such examples suggested the possibility of alternative models of economic growth and development to those driven by large-scale integrated enterprises. Together, this decline of large firms, and the allure of alternative growth models based upon clusters of smaller companies, created what appeared to be a new environment for competing. By the mid-1980s, this change was apparently so pervasive that Michael Piore and Charles Sabel, in an influential book, argued that the capitalist economy had arrived at what they termed, *The Second Industrial Divide*.

Piore and Sable compared this historical conjuncture to a similar moment during the previous century when mass production emerged from craft production. In the divide of the 1980s, however, the strategy that they advocated for relaunching growth was based upon a vision of transition to smaller --

and more importantly -- more flexible forms of business enterprise (Piore and Sabel, 1984: 6). They found inspiration for this vision not only in certain industrial communities of craft production in the nineteenth century that, in their view, represented historical alternatives to mass production.<sup>20</sup> Piore and Sabel were able to reference the existence of smaller and medium sized firms clustered in numerous place-based industrial districts as the actual living seeds of the new industrial order. What distinguished these communities both past and present, were networks of firms based upon relationships of cooperation and competition. Regardless of whether the prescriptive vision of Piore and Sabel was viable, they had uncovered in these networks of firms an emerging trend in economic and organizational development. What followed in the wake of Piore and Sabel's book was an enormous amount of new theorizing about interfirm networks as a new form of business enterprise.<sup>21</sup>

Much of this theorizing about regionally concentrated networks of firms derived from two basic and overlapping convictions.

First was the affirmation that the integrated firm was in a deep, and perhaps irreversible malaise, its crisis the result of internal bureaucratic rigidities stemming from integration as an organizational form that precluded possibilities for innovation. These organizational characteristics, that at one time may have enabled the vertically integrated enterprise to compete effectively, now tended to act as blocks on innovative learning and the development of capabilities to enhance competitiveness. Implicit in this critique was the notion that as an organization, the integrated firm possessed little capacity for adapting to a more competitive market environment. At the same time, as part of this critique was the embrace of interfirm networking as a solution to the problems of the large-scale integrated firm. These network organizations, it was argued, promoted pathways of learning and adaptability that enabled them to innovate and compete. As institutions, integrated firms, from this perspective, were becoming

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<sup>20</sup>This idea was developed more fully at roughly the same time in Sabel and Zeitlin (1985).

<sup>21</sup>There is a vast literature on this topic of industrial districts and networks of firms. For an overview of some of the earlier theorizing see Pyke et al., 1990 and Scott, 1988.

competitively inferior if not obsolete while enterprises organized from networks of firms were hallmarks of the future.

Secondly, and perhaps more profoundly was the conviction was that existing theories on the nature of the firm provided little insight about interfirm networks as a specific organizational phenomenon. The dichotomy between contracting relationships undertaken through markets, and contracting relationships organized administratively within firms, first developed by Coase and later refined by Williamson and Chandler, was from the perspective of these theorists, insufficient as a framework for explaining the emergence and proliferation of interfirm contracting relationships in the aftermath of the profit crisis of the 1970s and 1980s. Signals for such a perspective, however, had already emerged independent of, and prior to the competitive crisis of large firms.

In an extremely compelling article on industry and organization, G.B. Richardson argued that “by looking at industrial reality in terms of a sharp dichotomy between firm and market we obtain a distorted view of how the system works” (Richardson, 1972: 884). His observations on forms of networking and contracting relationships between firms in the economy suggested firstly that business organization was highly contingent, and secondly that the choices made by firms on forms of organization represented a continuum passing from pure market-type transactions, through intermediate forms of cooperation, to cooperation fully and formally developed within the same organization (Richardson, 1972: 887). For this reason, Richardson was highly critical of the dichotomy between firm and market which he claimed “leaves out of account...the dense network of cooperation and affiliation by which firms are inter-related” (Richardson, 1972: 883). Richardson’s insights about networks as unique forms of organization resonated strongly in the more recent theorizing of network enterprises. “Neither Market, Nor Hierarchy,” expressed this rejection of the lineage established by Coase (Powell, 1990).<sup>22</sup>

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<sup>22</sup>“I do not share the belief that the bulk of economic exchange fits comfortably at either of the poles of the market-hierarchy continuum... My aim is to identify a coherent set of factors that make it meaningful to talk about networks as a distinctive form of coordinating economic activity” (Powell, 1990: 298, 300-301).

From this framework, several contributions have attempted to explain the nature of interfirm networks as forms of business organization, and issues of governance and coordination that supposedly make them uniquely innovative.

Manuel Castells is perhaps the most emphatic in affirming the uniqueness of interfirm networks as an organizational form of business enterprise. Castells, however, has a far different point to make than simply distinguishing networks from either markets or hierarchies. He equates this organizational phenomenon --“linkages between economic agents” -- with what he insists is a broader, historically unique, networking phenomenon in the economy linked to “the information technology revolution” (Castells, 2000: 5, 77). These linkages are essentially horizontal relationships in which the operating unit of the business is not really a firm, but is instead more a *project* enacted between nodes in networks (Castells, 2000: 177, 214). For Castells, such ephemeral forms of organization correspond to the flexible nature of economic activity in the new millennium, and the need of business enterprise for adaptability to compete in the restructured environment of capitalism dominated by the Internet. Project-oriented linkages can be easily transformed and reconstituted as business needs change, and as conditions for profitability are redefined. Nevertheless, if as Castells argues, these networks are unique to the information technology revolution, is it technology that is creating these forms of organization? And, if networks are linked to the information technology revolution, what is one to make of interfirm networking prior to this revolution? Furthermore, apart from references to the power of information technology, it remains unclear what the mechanisms of coordination and governance are within this new organizational form that enable them not only to function, but function more innovatively than other forms of organization.

In contrast to Castells is the literature describing the networking phenomenon as *commodity chains*. This phenomenon is defined as a network of production and labor processes the end result of which is the creation and sale of a finished commodity. It differs from Castells in acknowledging the existence of commodity chains as forms of capitalist business organization dating from the early period of capitalism in the sixteenth century. In effect, the literature on commodity chains takes a more long-term

view of interfirm networking and its role in the development of capitalism. At the same time, however, it acknowledges that commodity chains in each period possess unique attributes. This historically based perspective derives from a synthesis of two unlikely intellectual partners. On the one hand, theoretical inspiration for this literature derives from the “world systems” approach to capitalist development in which different commodity chains spanning great distances across the globe fuel capitalist expansion beginning in the sixteenth century (Hopkins and Wallerstein, 1994). On the other hand, this approach draws upon Michael Porter’s notion of the value chain defined as “an interdependent system or network of activities connected by linkages” that represent the various adjacent stages in the production and distribution of goods and services (Porter, 1990: 41). In borrowing from both world systems theory and value chain theory, the commodity chain approach focuses on goods as a complete process of production, labor, and marketing. It seeks to reveal where the different parts of this process occur geographically, and who controls the process (Gereffi and Korzeniewicz, 1994: 2; Hopkins and Wallerstein, 1994: 50).

Commodity chains have three primary characteristics (Gereffi and Korzeniewicz, 1994: 7). Firstly, they have an input-output structure corresponding to a sequence of value-adding activities at different nodes. Secondly, they have a “territoriality,” that is, a spatial dispersion and concentration corresponding to the location of the various activities in the commodity chain in space and the way these activities occupy space. Thirdly, commodity chains have a governance structure in the form of authority and power relationships within the network. These attributes, however, give commodity chains an historically specific character. During the late nineteenth and early twentieth centuries, certain types of commodity chains were actually internalized within the boundaries of vertically integrated corporations where they coordinated mass production activities over national territories. What is distinct about the late twentieth century is the transformation of commodity chains into networks of independent firms organizing adjacent operations of procuring, producing and selling around the globe (Gereffi and Korzeniewicz, 1994: 7). Within these interfirm networks, profitability shifts from one node to another as an outcome of work organization, and the distribution of power between the different nodes. Power, in effect, plays a key role in the governance of these organizations.

Related to this approach but offering an analysis of more recent and specific forms of interfirm organization is the work of Tim Sturgeon who uncovers what he considers a new model of network organization: the *turnkey production network* (Sturgeon, 1997a; 1997b). Functionally, this new entity is characterized by the separation of innovative capacity and production capacity marked by a distinctly new form of production outsourcing. Organizationally, this separation is represented by the emergence of a distinctly new institutional entity: the *contract manufacturer*. Sturgeon observes that since the mid-1980s and particularly in the 1990s, large American name-brand electronics companies such as Apple, IBM, Hewlett Packard, and indeed Dell Computer have been abandoning their internal manufacturing operations, and turning to contract manufacturers such as SCI, Solectron and Flextronics to actually build their products. These contract manufacturers build the products of their clients through what is known as a turnkey contract (Sturgeon, 1997a: 11). The contractor assumes responsibility for production, while design and marketing are retained inside the boundaries of the name brand firm. The contractors themselves undertake this production activity through myriad subcontracting arrangements, dispersing and concentrating production in complex networks throughout the world. Costs, the diffusion of capabilities and skills, and the retreat of brand name firms into “core competencies” drive the development of this new networking organization.

By contrast, in the work of Saxenian, networks of firms, emerging from specific industrial systems, are the sources of innovation and competitive advantage that differentiate firms within one region from firms in another, and the regional economies where firms operate. Silicon Valley, according to Saxenian, is a network-based industrial system (Saxenian, 1994: 9). It is an innovative region because the industrial system upon which the region is built, promotes horizontal and decentralized interfirm network relationships. These interactions, in turn, emerge from, and at the same time reinforce relationships built from mutual reciprocity and trust. Network-like ties between specialized firms enable multiple and spontaneous interactions to occur that create ongoing recombinations of knowledge and information sharing. Such network relationships are the basis for a process of collective technological learning (Saxenian, 1994: 9). Issues of governance structure and coordination in these networks,

however, are not explicitly specified. While on the one hand, reference is made to the increasing specialization and division of labor in Silicon Valley, there is, on the other hand, strong suggestion that the interactions and relationships so central to innovativeness are not conducted at all through markets. Instead, cooperation between partners in the decentralized networks of Silicon Valley seems to more closely resemble non-market coordinated interactions based on relationships. Consequently whether by accident or design, Saxenian raises an interesting puzzle about the structure of organizations that are neither market nor hierarchy. While a highly specialized division of labor drives the existence of interfirm networks, they appear to contract through relationships lying outside the market.

Although in Saxenian the issue of coordination in interfirm networks is posed but not answered explicitly, in a provocative paper by Richard Langlois, this issue receives a more definitive treatment. In this paper, Langlois concedes that the world described by Alfred Chandler represented an industrial revolution marked organizationally by vertical integration and governed by the visible hand of management. He suggests that the current period is characterized by a revolution “at least as important as the one Chandler described...as profound as the one of the late nineteenth century.” In contrast to the enabling technologies of the rail and telegraph, this revolution has as its technological infrastructure the computer and the Internet. In place of mass production processes, the current revolution is one based upon modularity. Finally, and perhaps most importantly, while the earlier revolution replaced Adam Smith’s visible hand with the visible hand of planning and administrative coordination, the current modular revolution is marked increasingly by “coordination through arm’s length trading on thick markets...In this epoch, Smithian forces may be outpacing Chandlerian ones” (Langlois, 2001: 2). This new form of governance is called by Langlois, “The Vanishing Hand.” This paper is brilliantly argued but, as revealed in Chapter 6, there may be good reasons why the invisible hand of Smith, and interfirm business networks forged around processes of modularity, are not necessarily well matched. Instead, it is the visible hand of Chandler that may be more suitable as a coordination mechanism even for certain types of interfirm networks. In this sense it is helpful to revisit remarks made over thirty years ago by Richardson. “Planned coordination does not stop at the frontiers of the individual firm,” he writes, “but

can be effected through co-operation between firms....anti-trust legislation has checked vertical integration, but the same co-ordination is achieved through close co-operation between individual firms at each stage....Cooperation may come close to direction when one of the parties is clearly predominant;" (Richardson, 1972: 895-896). For Richardson, power, exercised through administrative coordination, is as compatible in interfirm networking as it is in vertical integration.

### **Communications As Revolution**

Few inducements to innovation and organizational transformation are as profound as a fundamental change in the means by which society communicates. As William McNeil has written recently, "major landmarks in human history" along with "the impulse to innovate" depended on improvements in communications that allowed messages to travel farther and more accurately across time and distance..." (McNeill, 2000: 9). It was historian Robert Albion, however, who was the first to write extensively about the impacts of what he described as the "communications revolution" on economy and society (Albion, 1932; John, 1994).

Albion originated this concept to describe the creation of an unprecedented, "veritable age of speed" beginning in the late eighteenth century but occurring most decisively during the nineteenth century, with which new transport and communications networks moved goods, people, and information (Albion, 1932; John, 1994: 101). This preoccupation with speed led him to highlight the importance of the communications revolution in the United States where speed was critical in bridging the enormity of continental-sized distances. Although he insisted that the communications revolution emerged independently of industrialization -- "it had performed wonders while our industries were still legitimate 'infants'" -- he acknowledged the impacts of new transport and communications systems on the growth of the "Machine Age" and "Big Business" (Albion, 1932: 718-19).

Despite its pioneering attributes, Albion's concept did not seek to develop systematic connections between new transport and communications systems, and broader economic changes in production technology and business organization. Albion was more concerned with describing the wide-ranging

social effects of the new infrastructure. It was left to one of Albion's students, Alfred Chandler, to provide these links between new communications technologies and transformations in business organization.

Similar to Albion, Chandler emphasized the role of speed in the compression of geographical space as the defining breakthrough of a communications revolution based on the railroad and telegraph. What Chandler did was to make explicit the connections between the revolution of rails and telegraphy, the emergence of the integrated corporation of the late nineteenth century, and the system of high-volume production and distribution built upon economies of speed. In building his model of organizational transformation on the rail and telegraph revolution, Chandler, in fact, was largely responsible for introducing transport and communications infrastructure as a category of historical analysis and catalyst of economic change (John, 1994: 102).

What Chandler represents in terms of the communications revolution of rails and telegraphy, has its counterpart in the work of Castells on information technology (1996). Like Chandler, Castells seeks to demarcate an historically unique economic and social phenomenon in the late twentieth century that he describes alternately as *The Information Age* and *The Network Society*. His point of departure in accounting for this phenomenon is "The Information Technology Revolution" that emerged in the 1970s and is represented in its most recent manifestation by the Internet (Castells, 1996: 5).<sup>23</sup> For Castells, this revolution consists of the converging set of technologies in micro-electronics, computing, telecommunications, and biotechnology (Castells, 1996: 29). These technologies and the revolution they have engendered, have shaped the restructuring of capitalism since the 1980s (Castells, 1996: 13). For Castells, the source of the "new economy" created from this restructuring process is unmistakable. "This new economy emerged in the last quarter of the twentieth century" he writes, "because the information technology revolution provided the indispensable, material basis for its creation" (Castells, 2000: 77).

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<sup>23</sup>Castells is careful to point out, however, that "technology does not determine society." He insists instead that "technology *is* society" (Castells, 1996: 5).

Castells is convinced that the information technology revolution represented most decisively by the Internet, and the informational economy spawned from it, reveal decisive breaks with industrial society preceding it. While conceding that past forms of economy relied on the processing of information, Castells distinguishes these previous *information* societies from the *informational* society that has emerged only in the last 25-30 years. In the informational economy, productivity and competitiveness derives from the capacity of economic agents to generate and process knowledge-based information whereas in the industrial economy of the past, the source of productivity derived from manipulation of materials and access to sources of energy (Castells, 1996: 17, 66). The information technology revolution is thus an historical discontinuity on the same level as the industrial revolution of the eighteenth and nineteenth century (Castells, 1996: 30). In his work is a call to historians of technology to compare and contrast the recent period of transformation marked by the Internet, with analogous transformations in the past (Castells, 1997: 244-245). Castells is certain that history will judge the current period of the Internet Revolution to be one of epoch-making discontinuity. Comparison of the innovative enterprises created by Swift and Dell may very provide a test case for such a verdict.

### **Toward Synthesis**

The starting point for comparison of Swift and Dell is Schumpeter's observation that capitalist development is punctuated by waves of discontinuous technological innovation beginning in the late eighteenth century. These waves demarcate distinct periods of industrial revolution in the development of modern capitalism. Each period is distinguished by a set of dominant technologies defined broadly as ways of working and getting things done. Around these technologies cluster specific types of economic routines, business organizations, political structures of economic rulemaking, and geographies of economic activity delimiting market territories for producing, buying and selling. Competition and the search for profit compel firms in these periodized environments to seek more innovative and efficient ways of accumulating. This process of search is a learning process. In this learning process, firms confront problems posed by existing economic routines, business organizations, politics and geography

that limit ways of getting things done. The learning process is an effort to overcome such limitations by solving the problem of how to think, and more importantly, act differently about profit-making. At the same time, these environments condition the range of choices available to actors in learning about, and seeking to implement more innovative solutions for producing, buying and selling. Although each of these periods is unique, common patterns in this process of innovation create historically comparable economic environments across time.

Among the most disruptive historical forces transforming this environment is the phenomenon of communications revolutions. Two groups of firms create this phenomenon and act as agents for the process of innovation in which the disruptive impacts new transport and communications technology emerge, spread, and transform the rest of the economy. Igniting this phenomenon are *builders* of the new transport and communications infrastructure. Within this group are a variety of different actors -- inventor entrepreneurs, investors, and firms that undertake actual construction and build-out of transport and communications infrastructure. Invariably government assists the efforts of this group. Extending this phenomenon are business *users* of the new transport and communications systems. These firms complete a more sweeping set of changes in the economy by using the new infrastructure to transform existing business models for profit-making. The interaction of these two groups shapes the deployment and build-out of the new infrastructure systems, and the pathway of transformation throughout the rest of the economy resulting from it (Cohen et al., 2000).

The roles of builders and users in creating the communications revolution and spreading its impacts, reveal certain identifiable patterns.

This pattern starts with a breakthrough invention in transport and communications technology that is exploited and commercialized by inventor entrepreneurs within the ranks of communications revolution builders. Although patent rights frequently protect the new invention, the patent process has a limited impact in stemming the entry of numerous companies anxious to capitalize on the commercial potential of the new technology as a built system. Accordingly, the ranks of companies interested in transferring the new technology into built systems, and constructing new infrastructure for such systems -

- rail, telegraph, and Internet firms -- explode soon after this first stage of commercial success. Hundreds of competing companies get involved in this early period of initial infrastructure creation and development.

During the early stages of new infrastructure development, multiple variants of the new transport and communications technology emerge among the different firms, creating intense competition to define the most technically superior system design. As these myriad firms compete to build-out the new systems, the competitive process gradually gives way to a process of consolidation in which a small number of builder firms survive. During this process of contraction in the number of builder firms, the multiple variants of the new technology created at the outset of commercialization also diminish. The surviving firms compete ferociously to establish a dominant design or standard defining the path along which subsequent infrastructure development takes place. At stake in these standards wars is control over future profitmaking. On the one hand, individual firms seek to use their mastery over a particular technological design to set the terms for subsequent development of the infrastructure. Secondly, firms that successfully develop a dominant standard are in a position to control terms of infrastructure access and use. The telegraph, the railroads, and the Internet all went through this process of standard-setting – with clear winners and losers.

The build-out of new transport and communications infrastructure by builder firms has a transforming effect on the profit-making environment of system users by reconfiguring the economic geography of markets. In the first place, the deployment of the new transport and communications systems provides users with the capabilities for new and different levels of *access* across and within markets for buying, selling, and producing. Secondly, these new levels of access create a different structure of *costs* in moving goods and securing information between distant markets, and between areas of proximity within markets thereby changing the costs for procuring, producing, and marketing. Such new structures of access and costs alter the geography of markets by redrawing the boundaries formerly separating market areas and the agents operating in those areas, and by reorganizing the activities and relationships between economic actors within market areas. What firms confront as the geography of

markets is upended by new structures of access and costs, is a reconfigured system of time and space relationships in economic activity. Shifts in the geography of markets alter the profit-making environment by confronting firms with the problem of controlling a reconfigured structure of time and space relationships in economic activity.

Control over time and distance is an ongoing strategic, operational, and organizational concern for the firm throughout capitalist development (Schoenberger, 1997: 12). Businesses are constantly engaged in framing and reshaping their strategies, routines, and organizations in an effort to overcome the barriers, temporal and geographical, to accumulating profit. Changes in the geography of markets act as inducements on firms to learn new capabilities for controlling time and space differently as they procure, produce, and sell.

The environments where such learning is possible and where opportunities exist for controlling time and space in new ways, are highly contingent. Certain firms grasp the profit-making opportunities associated with the communications revolution more decisively than others, and integrate the new infrastructure into their business models in accordance with their understanding of such opportunities. Nevertheless, the business models of such innovative firms do not emerge fully-formed. They evolve as incremental experiments in a process of learning by doing. Gradually, through such forms of trial and error, firms create systems of codified and tacit knowledge. This knowledge is the basis of more competitive, strategies, routines and forms of business organization -- capabilities -- through which firms procure supplies, fabricate goods, and market finished products. It is also the foundation from which firms evolve into innovative organizations.

Business organizations are inherently territorial. They assume this territorial character in the way they choose to organize economic activities in geographical space. Firms organize their activities geographically in the way they locate their own physical assets or *nodes*, and in the way they organize the flows of activity between these nodes, and the nodes of other firms with whom they interact in producing, buying and selling. While to some extent, the location of nodes, and the configuration of flows reflect the capabilities of available transport and communications technology, nodes and flows also emerge as a

function of the way firms choose to organize internally. Such choices involve the extent to which firms are integrated and absorb sequential steps in procurement, production, and marketing, and the degree to which they are dis-integrated and contract with other firms in allocating these tasks. These choices on firm structure influence the locations of key assets, and the routes by which flows of economic activity between these assets circulate. In this way, innovations in business organization deriving from the influence of the communications revolution and the process of organizational learning, reshape territories of profit-making.

The outline of this route from communications to territory depicted in Figure II-1 can thus be summarized as follows.

From a given profit-making environment, new transport and communications technologies emerge establishing the initial impulses of the communications revolution. These new technologies become commercialized by entrepreneurial infrastructure builders who deploy and build-out new transport and communications systems. When reaching a certain threshold, this build-out creates fundamental changes in the economic geography of markets, and the structures of access across and within market boundaries. Such changes in the geographical organization of market space, combined with the enhanced capabilities of the new infrastructure itself, provide opportunities for accumulating profit differently.

In this environment of initial infrastructure build-out, certain businesses learn to exploit the new infrastructure, and the new structures of access created by these systems to accumulate profit differently. What emerges from this process of learning are initial experiments, through trial and error, with innovative routines for profit-making. Gradually, in an ongoing process of learning by doing, firms develop new capabilities to carry out these innovative routines.

As they enhance their capabilities and assume the role of innovative enterprises, firms transform the organizational structure through which they carry out their operations and compete. Innovative business organizations, in turn, recast geographical landscapes for profit-making by shifting the locations of productive assets, and by rerouting flows of activities between these assets and the assets of other

entities with which they interact in the course of procuring producing and selling. In certain instances, profit-making in these reconfigured territories requires new systems of rulemaking to accommodate the innovations in routines and the business organizations developed for the new activities. Collectively, these changes -- transport and communications technology, market geography, business routines, organizational structure, territorial transformation, and market rules -- produce a new profit making environment (profit-making environment *prime* in Figure II-1). This environment then paves the way for the next communications revolution -- communications revolution *prime* -- and the process continues.<sup>24</sup> Such shifts in market geography transform the profit-making environment by providing users with opportunities for learning how to compete and accumulate differently. At the same time, new transport and communications infrastructure itself provides user firms with new and different technical capabilities for exploiting these opportunities.

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<sup>24</sup>Nevertheless, the process is not circular implying historical repetition. Instead, the process is conceived as a spiral representing parallel historical experiences within an overall context of development and change.