

Chandler's Living History: The Visible Hand of Vertical Integration in 19th Century America Viewed Under a 21st Century Transaction Costs Economics Lens

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Alfred Chandler's recent passing is cause to review and celebrate his many contributions to business history. It also presents an opportunity to highlight links between his rich historical analyses concerning organizational and industrial innovation and contemporary management studies of the firm and industrial organization. We illustrate this point by applying transaction costs theory to several case studies from his 1977 masterwork narrating the emergence of vertically-integrated firms in nineteenth-century America, *The Visible Hand*. Vertical integration, organizational control and innovation in manufacturing at McCormick Harvester and Singer Sewing Machines, in transportation and distribution at Swift and United Fruit reflect managerial responses to classic transaction costs considerations including commercial relationships requiring the creation of specialized equipment and knowledge. Transaction costs analysis provides complementary historical insight on organizational innovation at these and other firms in the nineteenth century, and suggests when and where we might expect vertical integration strategies in emerging industries of the twenty-first century. Chandler's *Visible Hand* transcends business history to provide timeless insights and fundamental lessons on how innovative firms re-draw organizational boundaries and structures for efficient and effective innovation.

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America Viewed Under a 21st Century Transaction Costs Economics Lens***

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Alfred Chandler's recent passing is cause to review and celebrate his many contributions to business history. It also presents an opportunity to highlight links between his rich historical analyses concerning organizational and industrial innovation and contemporary management studies of the firm and industrial organization. We illustrate this point by applying transaction costs theory to several case studies from his 1977 masterwork narrating the emergence of vertically-integrated firms in nineteenth-century America, *The Visible Hand*. Vertical integration, organizational control and innovation in manufacturing at McCormick Harvester and Singer Sewing Machines, in transportation and distribution at Swift and United Fruit reflect managerial responses to classic transaction costs considerations including commercial relationships requiring the creation of specialized equipment and knowledge. Transaction costs analysis provides complementary historical insight on organizational innovation at these and other firms in the nineteenth century, and suggests when and where we might expect vertical integration strategies in emerging industries of the twenty-first century. Chandler's *Visible Hand* transcends business history to provide timeless insights and fundamental lessons on how innovative firms re-draw organizational boundaries and structures for efficient and effective innovation.

Key words: Business history, transaction costs theory, vertical integration, contracting

INTRODUCTION

The enduring legacy of Alfred D. Chandler (1918-2007) is first-rate scholarship that integrates the “logic-in-use” of business decision makers with “reconstructed logic” (Kaplan, 1964) taken from theoretical frameworks in economics, management studies, organization theory, and sociology. Porter (1992) maintains that Chandler’s influence in business history has been enormous and that virtually every contemporary work on the history of the large-scale business enterprise must come to grips with Chandler’s analytical frameworks. Similarly, Galambos tells us that “[t]he dominant paradigm in business history has for many years been the synthesis developed by Alfred D. Chandler” (1997: 287). In our judgment, Chandler’s distinctive competence is best expressed in his own words. He was interested in understanding “how the historian can take what he needs from the concepts of the other disciplines without in any sense of being captured by them” (McCraw, 1988: 1). Of course, Chandler did much more than simply *apply* theory to the historical record. Williamson (1985: 11) made that clear in his assessment of Chandler’s first masterwork, *Strategy and Structure*:

In many respects [Chandler’s] historical account of the origins, diffusion, nature, and importance of the multidivisional form of organization ran ahead of contemporary economic and organization theory. Chandler clearly established that organization form had important business performance consequences, which neither economics nor organization theory had done (nor, for the most part, even attempted) before. The mistaken notion that economic efficiency was substantially independent of internal organization was no longer tenable after the book appeared.

Williamson (1985) understood Chandler’s (1977) deeper genius. Chandler (1977) recast business history in the crucible of social science theory. The resulting product was more than just narrative about the organizational evolution of American business. It was critical analysis of

social science theories and theorists, as this excerpt from Chandler's second masterwork, *The Visible Hand*, conveys (1977: 490):

Economists have often failed to relate administrative coordination to the theory of the firm. For example, far more economies result from the careful coordination of flow through the processes of production and distribution than from increasing the size of producing or distributing units in terms of capital facilities or number of workers. Any theory of the firm that defines the enterprise merely as a factory or even a number of factories, and therefore fails to take into account the role of administrative coordination, is far removed from reality.

Chandler drew on a range of theoretical perspectives to understand the past in *Strategy and Structure*, in *The Visible Hand*, and in his third masterwork, *Scale and Scope*. The current paper complements Chandler's theoretical pluralism with a review of organizational evolution in American business viewed under a single theoretical lens, namely transaction costs economics (Coase, 1937; Williamson, 1996). This paper utilizes transaction costs theory to review, explain, and predict a particular phenomenon --- vertical integration in the United States in the time period from 1840 -- that marks the beginning of a great wave of organizational innovation -- to 1920, which concluded the focal time period of Chandler's (1977) *The Visible Hand*.

We are not the first to use transaction costs analysis on Chandler's work. Williamson (1975), Hill (1988), Mahoney (1992), Poppo (2003) and Mayer and Whittington (2004) have also drawn on transaction costs perspectives to re-consider Chandler's work, but that work has been *Strategy and Structure* (1962), Chandler's history of organizational evolution in the early to mid-twentieth century. There has been comparatively little transaction costs analysis of *The Visible Hand*, although the more general influence of the book has been substantial (John, 1997). Such an undertaking would likely receive at least partial support from Chandler, who also appreciated transaction costs theory and theorists: "Because of his concern with firm-specific assets and skills, I, as an economic historian, have learned much from Williamson" (Chandler,

1992: 85). Our analysis of *Visible Hand*, therefore, extends recent research efforts to illuminate and inform business history with transaction costs perspectives that Chandler himself read broadly and incorporated.

To be clear at the outset, focusing on a single theoretical lens may have the advantage of highlighting and revealing certain insights from business history that Chandler has provided in his masterworks and other writings. However, focusing on a single theoretical lens may also underplay aspects of the history of vertical integration, including strategic issues concerning path dependencies, goals of antitrust, entrepreneurial talents, domination, market power, (internal) capital market, and life-cycle explanations (Argyres and Liebeskind, 1999; Bittlingmayer, 1996; Livesay, 1989; Marglin, 1974; O’Sullivan, 2006; Stack, 2003; Stigler, 1951). That said, the current paper pushes hard on transaction costs theory for interpreting the historical record of Chandler’s (1977) *Visible Hand*.

If we need theory to make sense of history, we also need history to make sense of theory (Gourvish, 1995; Lazonick, 1992). In important ways, transaction costs theory and Chandler’s (1977) account of business history are complementary. While transaction costs analysis provides a coherent conceptual model for interpreting the historical evidence, Chandler (1977) provides transaction cost economics with much relevant and needed institutional data (Robertson, 2003).

Mirroring the structure of *The Visible Hand* (1977), the current paper is organized as follows. Section 1 briefly discusses the time period preceding the 1840s in the United States in which the putting-out and inside contracting systems were in place. Advantages and (transaction costs) disadvantages are emphasized.

Section 2 considers the transformation of many businesses toward the modern vertically integrated firm. Particular attention is given both to technologically complex goods and to

perishable products. This section first considers machinery firms (e.g., Singer Sewing Machine and McCormick Harvester), which produced machines through the fabrication and assembly of interchangeable parts. Such high volume products required careful scheduling that was enabled by managerial hierarchy. These firms marketed their products via vertically-integrated value chains in which the machines were demonstrated and installed. These machines also required continuing after-sales service and repairs. Since wholesalers rarely had the capabilities to provide these services effectively, the vertically integrated enterprise enabled both the generation and the sustainability of competitive advantage.

This section then considers the production and distribution of perishable foods, such as meats and bananas. Here we learn other historical lessons concerning vertical integration. The effective scheduling of flows by managerial hierarchy was critical to prevent spoilage. Further, in order to prevent spoilage, effective distribution required massive (highly-specific asset) investments in refrigerated railroad cars, ships, and warehouses. Such data, as we shall see, provide grist for the transaction costs economics mill.

Finally, section 3 provides our analysis of the selective nature of vertical integration. Specifically, a transaction costs lens is brought to bear on the historical record for why vertical integration was observed in some industries but not in others in the United States, and provides discussion and conclusions concerning the historical and economic significance of vertical integration in the United States from 1840 to 1920, in which rapid change was experienced in the processes of production and distribution. Suggestions for future research and concluding remarks are provided.

Section 1: **The Putting-Out and Inside Contracting Systems**

Organizational innovation is an important factor in economic development. It may be argued --- and it was certainly the case before the scholarly contributions of Alfred D. Chandler --- that the social sciences under-appreciated organizational innovation. As the business historian Arthur Cole observed: “If changes in business procedure and practice were patentable, the contribution of business change to the economic growth of the nation would be (more) widely recognized ... (1968: 61-62). Refinements in cost accounting, collective bargaining procedures, and organizational form changes qualify as examples. This section focuses on a particular change: the substitution of more market-like mechanisms such as the putting-out and inside contracting systems by the *Visible Hand* of managerial hierarchy via vertical integration of manufacturers and distributors (Yao, 1988). We begin with an analysis of the putting-out system.

The Putting-Out System: The putting-out system existed in the United States from 1790 to 1840, and was a response to expanding market demand. In this business system, merchants purchased materials, delivered these materials to the workers in their homes and arranged for the sale of the completed articles. In contrast to handicraft manufacturing, the putting-out system was characterized by a separation of tasks --- a classic example of Adam Smith’s (1776) theory that “the division of labor was limited by the “extent of the market” (i.e., by demand). In the 1790s, metal goods, furniture, clothing, hats, and shoes were produced through the putting-out system (Gras and Larson, 1939; Hudson, 1981; Ware, 1931; Zakim, 1999).

The history of the shoe industry illustrates how the putting-out system developed in the United States from the 1790s to the 1840s. Blanche E. Hazard describes the role of the shoemaker, “who was simply to manufacture the boots and shoes, which a capitalist-entrepreneur marketed at his own risk and profit, supplying in whole or in part the tools and materials” (1913:

244). The central shop system rapidly developed after 1820 (Thomson, 1989). In this particular arrangement, workers did the fitting and when this process was completed, they were returned to the central shop and given to the “makers” who would sew the boots and shoes. The makers had to wait for their work to be inspected at the central shop.

The putting-out system had an attractive characteristic of preserving substantial worker autonomy. Moreover, the worker used the equipment properly since owners and operators were one and the same. However, because of the separate location of workers, inventory accumulation and transportation expenses were high. Further, this system encountered several transactional difficulties including: irregular production, loss of materials in transit and through embezzlement, slowness of manufacture, lack of uniformity, and uncertainty about the quality of the product (Babbage, 1835; Braverman, 1974; Kirkland, 1961).

In terms of quality-shading problems, Sidney Pollard (1965) maintained that the putting-out system inhibited the development of high quality, and consistent with this assessment, Faler (1981) notes that the system, which was centered in Lyon, Massachusetts, was mostly used to produce cheaper shoes for growing southern and western markets rather than those specializing in high quality shoes for the more traditional eastern markets. Similarly, Goldin (1986) maintains that, in general, the risk of quality shading for low quality goods is less than for high quality goods and finds that high quality coats were made by wages on time rates, while lower quality coats were made by piece rates. One can presumably monitor output quality less expensively for lower quality goods (Cheung, 1983). In sum, due to transactional problems, by 1860 the putting-out system was almost completely eliminated in the United States, with clothing in the larger cities providing the one remaining vestige of the older putting-out system (Chandler, 1977: 246).

The Inside Contracting System: Another method of coordinating activities utilized in the nineteenth century was the system of inside contracting, which was widely used by New England and Middle Atlantic manufacturers, especially among the metal fabricators and machine-tool builders. Inside contracting was common in such trades as typography, watch-making, mule-spinning, paper-making, glass-blowing, boiler-making, coal-mining, iron-molding, pipe-fitting, stoves, ship-building, locomotives, machine tools, firearms, military equipment, iron-rolling and steel-making (Clark, 1984; Clawson, 1980; Englander, 1987; Gillette, 1988; Nelson, 1975; Stone, 1981).

Harold Williamson (1952: 87) describes the development of the inside contracting system at the Winchester Repeating Arms Company:

The operation involved in manufacturing gun components and ammunition were delegated to super-foremen who hired and fired their own workers, set their wages, managed the job, and turned over the finished parts to the company for assembly. The company supplied raw materials, the use of floor space and machinery, light, heat, and power, special tools, and patterns for the job. The management credited the account of the contractor so much for every hundred pieces of finished work that passed inspection, and debited his amount for the wages paid to his men and the cost of oil, files, waste, and so on, used in production. Anything left over was paid to the contractor as a profit. In addition, the company paid him day wages as a foreman's rate as a guarantee of minimum income.

This arrangement in the Winchester Repeating Arms Company was the general business model utilized by those in the inside contract system. The one exception being, that while sub-contractors sometimes earned wages, they more often survived solely on the profits of the sub-contract (Edwards, 1979: 32).

The inside contracting systems illustrates that managerial hierarchy cannot be explained simply by a central power source. In the case of inside contracting, space within factories was rented to individual entrepreneurs before (as well as after) the development of a central power source. The impetus of the factory system has transaction costs origins (Williamson, 1980). An

advantage of the inside contracting system was that the firm was less burdened with increasingly difficult problems associated with production, process improvement, and labor supervision. The worker supervisor or master mechanic could obtain substantial independence and could avoid problems of marketing and finance. Further, according to Felicia Johnson Deyrup, the inside contracting system also played a fundamental role in the development of master tool building: “inside contractors were paid by the piece and hired their own labor, they benefited directly from increases in production or reductions in labor cost brought about by mechanization” (1948: 149).

Although the insider contracting system had its economic advantages, there were several economic disadvantages including: the high economic costs of inspecting work to safeguard against quality shading, contracting workers using machinery carelessly, and the problems of discipline and high absenteeism (Lane, 1973; Navin, 1950). Contractual problems incurred in the inside contracting system provide historical evidence to support transaction costs theory that to merely transfer a transaction from the market and to organize it internally, without more, does not fully harmonize the exchange (Eccles, 1981; Mahoney, 2005; Williamson, 1980).

That the inside contractor did not use the machinery properly is not surprising since the contractor is concerned with economic benefits generated until the contract termination date. Equipment repairs will therefore be deferred as contract termination dates approach. Pollard notes that: “In mines or quarries [using the inside contracting system], permanent damage was done to property by men interested in short-term returns only” (1965: 38).

In addition, the inside contracting system gave contractors economic incentives and opportunities to strategically withhold or distort information. Harold Williamson notes that at the Winchester Repeating Arms Company: “any discovery of how to speed up operations or to substitute unskilled labor for skilled labor by the use of some new jig or fixture could be

carefully guarded from management” (1952: 89). The concern of changing pay standards generates incentives to withhold details of the production process from the performance evaluator. Labor-saving innovation was delayed until after contract renewal. Capital-saving innovation is also likely to be low since the firm can appropriate a large share of the economic gain. Moreover, it was difficult to regulate the flow of components from each contractor and inventory control procedures were inadequate (Buttrick, 1952). There were no specific economic incentives for inside contractors to economize on inventory accumulation. Coordination was left to informal cooperation by the foremen of the departments. Also, the quality shading problems that accompanied the putting-out system continued to plague internal organization under the inside contracting system. North (1981: 168) notes that:

[W]here quality was costly to measure, hierarchical organization would replace market transactions, the putting-out system was in effect a “primitive firm’ in which the merchant-manufacturer attempted to enforce constant quality standards at each step in the manufacturing process. By retaining ownership of the materials throughout the manufacturing process, the merchant-manufacturer was able to exercise this quality control at a cost lower than the cost of simply selling and buying at successive stages of the production process. The gradual move toward central workshops (inside contracting) was a further step in efforts at greater quality control and presaged the development of the factory system (hierarchy) that was in effect the direct supervision of quality throughout the production processes.

In summary and utilizing transaction costs terms, managerial hierarchy mitigates the problems of excessive buffer inventories, improper equipment utilization, inadequate innovation disclosure incentives, and systemic quality shading that occurred in inside contracting systems. Thus, transaction costs analysis suggests displacement of the inside contracting system by a managerial hierarchy. The employment relationship mitigates bilateral monopoly contracting and permits fiat to be used in settling disputes. Adaptation may be achieved within a “zone of acceptance” (Simon, 1947). Furthermore, when the inside contractors become managers, they no

longer necessarily have claims to the semi-independent profit streams and consequently greater cooperation is realistically anticipated.

The authority relationship of managerial hierarchy provides good equipment maintenance incentives compared to inside contracting since asymmetric information problems are lessened since the firm can continuously monitor production, and operations can be subject to internal audits. Removal of semi-independent profit streams and improved auditing serve to attenuate inside contracting hazards, which are derived from small-numbers bargaining, asymmetric information, and free-rider behavior (Williamson, 1975).

High uncertainty and the subsequent need to coordinate successive value chain stages in the production process, and contractual problems inherent under conditions of asymmetric information and small-numbers bargaining between the firm and the contractor contributed to the demise of the inside contracting system, beginning in the late 1870s. For example, Singer Sewing Machine ended the inside contracting system in 1883 (Hounshell, 1984). Also, the Winchester Repeating Arms Company moved to reduce the number of contractors, and by 1914 the inside contracting system had been all but eliminated in gun production (Williamson, 1952: 136). Transaction costs pressures were leading to a competition among organizational forms in which the business landscape of the United States would fundamentally change in the 1840-1920 period (Chandler, 1977). The next section considers the transformation of these traditional enterprises into the modern vertically integrated firm.

Section 2: **The Transformation of Traditional Enterprise to the Modern Vertically Integrated Firm**

The 1840s mark the beginning of a dynamic institutional competition that saw rapid changes in the processes of production and distribution in the United States, which evolved into the modern corporation. In 1840, markets were small, there was a lack of large scale power sources, and transportation was expensive (Taylor, 1968), which kept the volume of transactions low. Therefore, as late as 1840, there were no middle-level managers in the United States, and the most advanced accounting methods were still those of Italian double-entry bookkeeping --- techniques that were similar to those used five hundred years earlier in 1340 (Chandler, 1977).

However, the rapid expansion of railroad networks in the 1840 to 1850 period induced a dramatic decrease in unit transportation costs. Standard microeconomic theory indicates that such a reduction in transportation costs will result in a rise in the least-cost scale of production, and, indeed, industrial enterprises after 1850 began to build new plants of unprecedented size. The dramatic change in production economies of scale (Atack, 1986; O'Brien, 1988), economies of scope (Chandler 1990, Teece, 1980) and changes in demand required an adaptive response in distribution (Barger, 1955; Higgs, 1971). Furthermore, the telegraph systems, which achieved commercial practicability by 1845 had blanketed the east and west and had reached Chicago, St. Louis, New Orleans, as well as other principal northern cities by 1850 (Du Boff, 1980). Thus, the essential infrastructure necessary for geographic expansion was in place by 1850, and the availability of coal, domestic iron and steam power enabled rapid growth of the manufacturing sector in the 1840-1870 period (Rosenberg, 1972).

Vertical Integration by Firms Producing Technologically Complex Goods: In the 1870 to 1895 period, as the basic transportation and communication infrastructure was nearly completion,

enterprises began to integrate mass production with mass distribution.¹ Here we focus on technologically complex goods, and begin with the Singer Sewing Machine, which was in many respects a pioneer in developing the channels of distribution. They were a pioneer consumer appliance, the first product to be sold under a consumer installment plan, and the first product to be sold through a fully developed franchised agency system (Jack, 1957), which enabled greater adaptation operating in markets with different social and economic characteristics (Carstensen, 1984). The reason for their organizational innovation is summarized by Mira Wilkins: “The independent agent did not pay sufficient attention to the product; he did not bother to instruct the buyer on how to use the machine; he did not know how to service it; he failed to demonstrate it effectively, and he did not seek new customers aggressively. Independent agents were not prepared to risk their capital to sell goods on installment, nor would they risk carrying large stocks” (1970: 43).

The new product required distributional innovation in order to demonstrate, instruct and assist the sewing-machine user (Hennart, 1994). By the mid-1950s, the Singer Sewing Machine Company had its own salesrooms to market the product, deliver the machines, assist consumers with trained personnel, maintain attractive outlets, carry on adequate stock of machines, parts

¹ Many large companies either merged or built their own systems to distribute their goods to the national market (Chandler, 1977; Schmitz, 1995). A partial list includes: (a) Makers of crude chemicals: Du Pont, General Chemical, International Agricultural Chemical and National Carbon; (b) Food processing enterprises: Del Monte, Nabisco, Quaker Oats and United Fruit; (c) Meat-packing firms: Armour, Cudahy, Morris, Swift, and Wilson (d) Metal firms: Alcoa; Bethlehem Steel, International Nickel and U.S. Steel; (e) Rubber companies: Firestone, Goodrich, Goodyear and United States Rubber; (f) Automobile firms: Ford, General Motors, Packard, and Studebaker; (g) Petroleum firms: Gulf, Shell, Standard Oil and Texaco; and (h) a variety of technologically complex products produced by such firms as: Allis-Chalmers, American Radiator, Babcock and Wilcox, Burroughs Adding Machine, Computer-Tabulating-Recording (the forerunner of IBM), Deere and Company, Eastman Kodak, Electric Storage Battery, General Electric, Ingersoll-Rand, International Harvester, J.I. Case, Johnson Company, Link-Belt Machinery, National Cash Register, Pittsburgh Plate Glass, Remington Typewriter, Singer Sewing Machine, Underwood Typewriter, Western Electric, Westinghouse Air Brake, Westinghouse Electric; Worthington Pump and Machinery, and the Otis Elevator Company, with their vertical integration of vertical transportation.

and accessories, and to repair the machines. In addition, these sales outlets provided information on market trends and competition so that product development advanced rapidly (Jack, 1957).

Indeed, Singer Sewing Machine was the first mass producer to build their own sales outlet. In comparison with the sales office, franchised agencies proved to be less effective and more expensive (Davies, 1969). Chandler observes that the economic advantage of the vertically integrated Singer company resided in its organization: “That managerial hierarchy recruited, trained, and carefully supervised the canvasser-collector, provided long-term consumer credit; assured continuing service of the machine sold; and, finally, permitted a smooth and reliable distribution of the 20,000 to 25,000 machines shipped each week to all parts of the world” (1977: 405). Therefore, the essence of Singer’s sustainable competitive advantage resided in its human and organizational capital and its superior distributional capabilities.

The merchandising efforts of the company’s own outlets proved so successful that by 1880, Singer Sewing Machine Company severed their relations with all independent merchants, and its distribution network maintained 530 retail outlets (McCurdy, 1978). By 1905, Singer Sewing Machine employed twice as many workers in marketing as compared with its production operations (Godley, 2006). Singer Sewing Machine also devised new types of accounting and statistical controls. The management accounting systems developed by Singer Sewing Machine and others allowed extensive vertical integration since these systems lowered internal integration measurement costs.

Vertical coordination also was significant to the success of McCormick Harvesting Company’s distribution of the complex mechanical (grain cutting) reaper with widespread use of advertising, warranties, and installment plans (McCormick, 1931). The company also appointed responsible agents to storage warehouses that they built at various locations. These salesmen

were also trained mechanics who assembled the machines when they arrived from the factory and demonstrated their operations to the potential end user. These experts were also needed to adjust the machines to local conditions and to make running repairs (Hutchinson, 1930). These agencies initiated the first large-scale franchising system --- with exclusive dealing arrangements --- in the United States (Casson, 1909). By the mid-1880s, the McCormick Company converted some of their establishments to vertically integrated stores with salaried managers, but not to the same extent as Singer Sewing Machine (Chandler, 1962).

Vertical integration was also prominent in electrical manufacturing systems. Changes in the scale and nature of operations in electrical manufacturing systems required the invention and application of new organizational forms. The significant characteristic of the market for electrical products was that business firms' "activities and requirements had to be known to the electrical manufacturers' salesman if the latter were to do an effective job of selling. In addition, the salesman had to make sure that the equipment was properly installed and that it operated satisfactorily. In effect, then, the electrical products salesmen were sales engineers (Passer, 1952, 1953). Therefore, the competitive advantages obtained by Westinghouse and General Electric (Broderick, 1929; Hammond, 1941) in the 1890s were due, in large measure, to their human and organizational capital.

The centralization of marketing at these companies enabled the sales forces to obtain information on consumers' specific needs. Communication between the production department and the marketing department enabled extensive coordination between customers with complex requirements and manufacturers with complex producing equipment. The marketing of electrical lighting, power machinery, and traction equipment was complicated technologically so that trained salesmen with expertise in engineering were essential. The vertical integration of

manufacturing and marketing enabled the development of specific language and standard reports, plans, and forecasts which speed up transmission and communication. In markets where such factors were less critical, vertical integration was less necessary. For example, General Electric and Westinghouse continued to market simple consumer products such as light bulbs through independent wholesale houses. Also standardized machinery, such as stationary steam engines, standard boilers, lathes and other similar machinery were sold in the market without reliance on vertical integration (Porter and Livesay, 1971).

Extensive marketing organizations were also necessary for new machines to be sold in high volume. National Cash Register Company dominated their business by setting up networks of branch retail outlets administered by regional offices. National Cash Register pioneered the use of exclusive territories to agents (Johnson and Lynch, 1932; Rosenbloom, 2000). They grew rapidly after 1885 when they provided credit and repair services and trained their own salesmen (Crowther, 1924; Friedman, 1998). Similar growth patterns have been documented for Burroughs Adding Machine, Eastman Kodak, and Remington Typewriter (Ackerman, 1930; Porter and Livesay, 1971).

Thus, the making of sewing machines, cash registers, cameras, and typewriters invested extensively in retail outlets. In each case, the machines were complex and only recently invented. Those firms that invested in firm-specific human capital by training their sales personnel, and by providing their users with extensive consumer credit, achieved a sustainable competitive advantage since independent distributors were confronted by too many contractual difficulties to secure adequate demonstration, repairs and consumer credit. Perhaps even more fundamentally, distributors would have been required to make firm-specific (human and organizational) capital investments and distributors were perhaps rightly reluctant to place themselves in a potentially

weak bargaining position. Moreover, from the point of view of the manufacturers, they could ill-afford having severe free-riding problems in the system and both initial franchising and often subsequent full vertical integration afforded these manufacturers a level of quality control that was essential for these new, complex products.

Vertical Integration by Firms Producing Perishable Goods: Not all vertical integration, however, involved complex *products*, and the case of perishable goods shows that even generic goods like meats and fruits required vertical integration when national markets required efficient distribution and expensive (sunk cost) coordinated systems of delivery. We consider the meat-packing industry and fruit businesses, in turn.

Meat-Packing Industry: One of the more prominent illustrations of the growth of firms via vertical integration was the history of the meat-packing industry. By 1880, urban areas such as Boston, New York, and Philadelphia were demanding more meat than could be supplied locally. The new technology of refrigeration (Anderson, 1953; Kujovich, 1970) enabled a supply of meat from cattle on the western plains to satisfy this growing demand in the east. Gustavus F. Swift hired a leading refrigeration engineer to design a railroad car with circulated cool air to carry Swift's dressed beef from Chicago to Boston (Swift, 1927), and other packers such as Armour, Cudahy and Morris followed in the use of refrigeration-cars.

The Grand Trunk and B&O Railroads agreed to haul the meat, but refused to build the refrigerated cars. We submit that the reason for this behavior can be explained by transaction costs analysis. The refrigeration car was expensive (\$25,000 per car), their maintenance costs were high, and it was restricted to only one type of cargo. Transaction costs theory suggests that refrigeration-cars, having no alternative use, entailed high asset specificity, in which the railroads were rightly reluctant to undertake. Railroads that built these cars would be in a weak bargaining

position to the meat-packers to provide sufficient volumes of meat to utilize fully this expensive equipment. In contrast, railroads did own their own general service cars, for when not in use to transport stock, these cars could be used for other freight (Clemen, 1923). Therefore, contractual hazards led the packers in Chicago to build their own refrigeration cars and to establish their own ice stations and branch houses in the east where representative aggressively sold their products.² Further, a problem in contracting with independent branch house dealers was that grading beef was difficult and lead to costly haggling (Armour, 1906; Rhoades, 1929). From 1880 to 1900, major packers created huge vertically-integrated industrial enterprises and the key economic costs savings were not due primarily to economies of scale in production, but rather to transaction costs economies in marketing and distribution (James, 1983).

The Banana Business: The banana business encountered more difficulties than the meat-packing industry for at least three reasons: First, bananas cannot be produced in the continental United States. Second, they cannot be frozen. And, third, they spoil very quickly. Since the late 19th century, when Americans started consuming bananas, close coordination between different stages of the business is crucial to successfully bring bananas from Central America and the Caribbean to the final consumer in the United States. Banana consumption in the United States evolved from being a luxury good in the 1880s and 1890s, to being considered an inexpensive fruit for the working class by 1910 (Bucheli 2005, Jenkins 2000). Importations of the tropical fruit from the Caribbean began in the late 1860s at the ports of New Orleans and New York (Reynolds, 1921), often arriving quite ripe after a slow journey in sailing ships. In the 1870s, the

² In addition to asset specificity arguments, producers and distributors may not achieve coordination due to a lack of “convergent expectations” (Malmgren, 1961). Innovative firms may be forced to undertake activities that they would like to outsource since these firms may have difficulty in conveying unfamiliar knowledge to others because the concepts are new and because they are hard for others to comprehend (Silver, 1984; Stigler, 1951; Teece, 1993). For this reason, we anticipate that current nascent high technology sectors of the economy may still require vertical integration as we move forward.

technology of the steamboat was applied to the banana trade, enabling more rapid movement of the highly perishable fruit from the tropics (Wilson, 1947). Most of these early attempts failed, however, because of the lack of coordination between the providers, the ocean transportation companies, and the distributors: between 1870 and 1899, 114 banana import companies were created, but only 22 survived by 1899 (Read, 1983). Since the fruit perished quickly, many shipments were lost. Coordination problems were largely solved only with the establishment of the United Fruit Company in 1899.

The United Fruit Company was the result of a merger of the interests of Minor Keith (the owner of an extensive railway system in Central America, several banana plantations, and who controlled the US southwest banana market), and Andrew Preston (owner of a steamship company – the Great White Fleet --, banana plantations in the West Indies, and who controlled the US northeast banana market) (Bucheli 2005). This merger created a company with both extensive backward and forward vertical integration. Porter and Livesay note that: “Middlemen played almost no role in this end of United Fruit’s operations so thorough was the process of backward integration” (1971: 176). The new merged company continued its expansion to other sectors in order to unify most of the value chain stages of the production process. The company established the Fruit Dispatch Company, a subsidiary in charge of distributing bananas in the United States. Also, Fruit Dispatch organized campaigns to educate Americans on nutritional benefits of bananas. United Fruit became a major shareholder of the Hamburg Line and Elders & Fyffes assuring control of the German and British markets. In 1913 the company created the Tropical Radio & Telegraph Company to maintain constant communication with its ships and plantations. The lack of basic infrastructure in some of the producing areas led the company to also invest in creating hospitals, roads, and housing facilities for its employees (Bucheli, 2005).

The company assured a steady flow of bananas by producing on its own plantations and by signing exclusive contracts that required local providers to sell all their bananas to United Fruit (Bucheli, 2004). In short, the United Fruit Company internalized otherwise external markets eliminating or minimizing different transactions costs, enabling them to efficiently handle their highly perishable goods.

Section 3: **The Selective Nature of Vertical Integration**

Sectors of the American economy continued under the traditional process of production and distribution where independent wholesalers and independent retailers continued to contract to distribute the goods. Goods sold through independent outlets included: breakfast cereals, soups, drugs, liquor, razor blades, hand soaps, jewelry, shoes and other leather products, textiles, hardware, plumbing and building materials, furniture, millwork and other wood products (Becker, 1971; Chandler, 1969; Thorp, 1924). For these goods, fungible human assets employed for retail sale and service were sufficient. Therefore, where the product was simple, and the market diffuse, producers continued to find the old means of distribution adequate.

However, where manufacturers were confronted by special marketing problems --- such as the need for rapid distribution with specialized investments (such as refrigeration cars for meats and beer); consumer credit needs by users; demonstrations (point-of-sale services); highly skilled repairs (after-sales, follow-on services); much greater attention to vertical coordination was required.

Where point-of-sale and follow-on services are essential, vertical contracting problems may ensue. Forward vertical integration into sales reduced transaction costs when extensive *complementarities* were substantial between manufacturing and distribution stages (Richardson,

1972). Vertically integrated value chains were more commonly used for products that required high service. Furthermore, those products where transaction-specific investments were required (e.g., sewing machines, office-machinery, harvesters, electrical equipment) were supported by franchising and later, for many, full vertical integration.

In transaction costs terms, vertical integration had comparative efficiency advantages due to economic incentive, adaptability, monitoring, dispute-settling, and reward-refining attributes. Therefore, when small-numbers problems (e.g., high asset specificity) and externality problems (e.g., free-riding behavior) existed between manufacturer and distributor, vertical integration was typically the winner in the competition among existing organizational forms. The financial success of Eastman Kodak, General Electric, Otis Elevator, and Singer Sewing machine, among others, illustrates the economic value of forward vertical integration into marketing where real economies were realized (Lamoreaux, 1985; Livermore, 1935; Nelson, 1959).

Conversely, when free-rider problems and asset specificity were low, experiments into vertical integration proved not to pass the market test (e.g., tobacco, sugar, beer). In the case of American Sugar Refining, manufacturers of an undifferentiated product attempted to forward integrate, which resulted in large economic losses (Porter and Livesay, 1971). Also, large brewers in the late 1800s attempted to develop a system of tied-houses, along the lines of the English system, with taverns having exclusive relationships with one brewer's product. The maintenance of such an organizational system proved to offer little strategic advantage and was very costly, which lead brewers to return to the older system of using markets and selling to independent distributors (Baron, 1962; Cochran, 1948).

Discussion: Looking at vertical integration through a transaction costs lens supports Chandler's (1977) assessment of the rise of the modern vertically integrated firm in the United

States in the 1840 to 1920 time period. Chandler states that the vertically integrated firm was “the organizational response to fundamental processes of production and distribution made possible by the availability of new sources of energy ... Changes in transportation, communication, and demand brought a revolution in the process of distribution. And, where the new mass marketers had difficulty in handling the output of the new processes of production, the manufacturers integrated mass production with mass distribution” (Chandler, 1977: 376). The current paper’s main contribution to the research literature is to explain *why* new mass marketers had (transaction costs) difficulties, and why in many sectors of the economy the visible hand of management within vertically integrated firms had a comparative economic advantage over what Adam Smith (1776) referred to as the invisible hand of market forces.

Transaction costs analysis addresses the sources of marketing difficulties and considers why vertical integration varies across industries. Where distribution externalities (free-riding) problems were substantial higher, the need to extend quality control via vertical integration was greatest. Quality shading by distributors may be very costly to detect in contractual relationships. Vertical integration has comparative efficiency properties that have been highlighted above. In addition to free-rider problems, transaction costs theory emphasizes the importance of asset specificity. High physical asset specificity lead to vertical integration as can be seen in the case of meat-packing. Further, human capital asset specificity proved to be critical for new complex goods such as sewing machines, harvesters, electrical equipment, and office machines.

In transaction costs terms, many transactions that took place in 1920 were fundamentally different from the transactions of 1840. The problems of large fixed capital investment that had low scrap value --- with the potential for highly appropriable quasi-rents (Klein, Crawford, and Alchian, 1978) --- and that required an exchange relationship over time under conditions of high

frequency and high uncertainty were now prominent in several major industries in the United States. Also, there were ever increasing costs to measuring the quality of goods and services (Barzel, 1982). Vertical integration was an institutional response to control problems of shirking in team production (Alchian and Demsetz, 1972) and the high transaction costs of negotiating and enforcing exchange agreements where physical and human capital asset specificity were becoming increasingly important, in a business environment of increasing consumer demands and rapid technological innovation. It was the development of new technologies and increased demand provided by the opening of new markets, which resulted in economies of scale and scope and in reduced transaction costs that made the vertically integrated firm come when it did, where it did, and in the way it did (Chandler, 1977; Williamson, 1996). Thus, the rise of the vertically-integrated enterprise brought with it managerial capitalism. In turn, the visible hand of hierarchical coordination helped integrate new processes of production and distribution, and enabled pioneering firms that adopted and developed this organizational innovation to generate and sustain competitive advantage.

What's Next? This paper highlights the benefits that business history offers to transaction costs theory. But transaction costs theory has much to offer business history. In the Economics discipline (Langlois, 2003) and in business history (Lamoreaux, Raff and Temin, 2003) it is maintained that Chandler's (1977) landmark business history lacked a fully developed theory of organizational change and consequently that Alfred Chandler had difficulty explaining the erosion that occurred in the position of these large vertically-integrated firms by the late twentieth century. Lamoreaux *et al.* (2003) go on to note that Williamson's (1985) transaction costs theory suggests that fundamental changes in the economic environment could dramatically affect the level of transaction costs, and thus that the relative advantages and disadvantages of

the visible hand of managerial hierarchy can change quite substantially over time (Brynjolfsson, Malone, Gurbaxani and Kambil, 1994). Here we build on these arguments to explain current trends toward vertical de-integration (Langlois, 2003; Robertson and Verona, 2006).

Shapiro and Varian maintain that: “Even though technology advances breathlessly, the economic principles we rely on are durable. The examples may change but the ideas will not go out of date” (1999: x). Indeed, transaction costs principles that help explain Chandlerian vertical integration are the same principles needed to understand contemporary vertical de-integration. First, asset specificity and small-numbers bargaining problems have been reduced since information technology can allow a firm to “quick connect” with a number of potential suppliers (Clemons and Row, 1992), which alleviates the need for vertical integration. Second, even when small-numbers bargaining is present, relationship-specific information technology systems (such as those employed by P&G and Wal-mart) provide mutual sunk cost commitments that enable *electronic integration* to mitigate hold-up problems sufficiently (Kim and Mahoney, 2006). Third, information technology and standardized interfaces with exchange partners and suppliers reduces the non-separability problems of measuring individual productivity inputs from team production (Alchian and Demetz, 1972) as well as the measurement output quality. Such improvements in measurement technologies have facilitated recent trends toward vertical de-integration (Lajili and Mahoney, 2006).

However, general trends toward de-integration can occasionally reverse themselves, particularly in emerging technology-intensive industries such as bio-technology. Pioneering firms seeking to commercialize new products and services may require highly coordinated research, manufacturing, distribution and after sales service relationships that a single, vertically integrated firm can provide. For example, to commercialize a generation of new agricultural

herbicides in the 1980s, Monsanto internalized most, if not all of these capabilities (Leonard-Barton and Pisano, 1990). In the 2000s, Monsanto seeks market leadership in a new generation of genetically-modified plant varieties where the basic science may be mastered, but where new product development, manufacturing processes and marketing practices around the world are still not standardized and widely diffused across related industries. Monsanto's commercial challenge in the twenty-first century is not unlike Swift's, McCormick's or United Fruit's in the nineteenth century: vertical integration, corporate control and internal innovation to build new markets. In this context, Chandler's *Visible Hand* is more than historical narrative of bygone business times. It is a timeless tale of organizational innovation informing both academic scholars and innovative practitioners.

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