Managerial Inefficiency and Technological Decline in Britain, 1860-1914

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British economic decline in the late nineteenth and early twentieth centuries has been attributed to the growing inability of British industries to compete technologically and organizationally with their American and German competitors. This paper argues that British firms' growth and adaptability were hampered by organizational weakness and that the major cause of Britain's managerial problems was the failure of British entrepreneurs to delegate enough authority to their subordinates in the firm. British industrialists' lack of delegation of authority is demonstrated to have prevented the actions necessary to keep up with foreign competition in the core industries of the Second Industrial Revolution. More specifically, it prevented the development of formal R&D programs, the promotion and efficient rationalization of mergers, the coordinated development of multiple parts of a technology or of the firm, and the balanced growth needed to keep up with foreign competition in all aspects of the firm, such as research, production, sales, marketing, accounting, and finance. At key moments in the development of many industries, British firms needed to invest in more extensive structures of management and failed to do so. Evidence from the development of the electrical and synthetic dye industries, as well as other examples of firms employing inadequate management structures, will be used to show how industrial and technological development were slowed by inadequate delegation of authority.

Much of the recent literature on British economic decline considers the culture and institutions of the British economy as the sources of British industry's poor performance. Two main explanations have emerged from this literature: first, that British industry invested in and employed a set of market institutions that were inappropriate for later conditions in particular industries (e.g., the textile industries) [7, 14]; second, that British cultural values, social traditions, and educational institutions caused bad management practices, the lingering of the family firm, and a general bias against work in industry,

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leading to entrepreneurial failure in the larger firms that existed in industries such as iron and steel [1, 13, 19].

In his recently published analysis in *Scale and Scope*, Chandler blames Britain's "entrepreneurial failure" on the different structure and size of Britain's markets, "the failure to make the three-pronged investment in production, distribution, and management essential to exploit economies of scale and scope," the inefficient internal organization of mergers in Britain, and continued family control of the firm due to cultural factors and the educational system [5, pp. 261-662 286]. This paper asserts that many of the observed characteristics of the development of British industry can be explained by assuming that the British were reluctant to delegate authority to their managers and, as a related issue, that industrial cooperation was lacking. This prevented British firms from taking advantage of much of the internal economies of scale and scope, particularly in new technological development and in coordinated growth strategy in areas such as marketing, production planning and control, finance, and R&D, which a number of foreign competitors in the United States and Germany had learned to develop. Thus at critical moments in the evolution of many industries, when American and German firms were finding that functionally decentralized decision-making was critical to their prospects for further development, British firms' management techniques were inadequate for maintaining their growth even if they had been successfully expanding in an earlier period.

It is assumed here that entrepreneurs are constrained in the time that they have available to run the business. To help them stretch this time constraint, successful entrepreneurs will design and build an organization to extend their ability to gather and process information, and take actions. Most of the organization undertake routine tasks in production, purchasing, shipping, and accounting. Employees are hired and trained to perform these tasks. When authority is delegated, subordinates (referred to here as "managers," since authority is usually delegated to those who manage others) are expected to act on information they alone receive or that their education, training, and experience are able to handle. The entrepreneur does not have the time to handle this information and sometimes does not have the training to handle it correctly. Allowing managers to handle other functions economizes on the entrepreneur's training required for the job, and saves him time.

However, there are dangers in delegating authority. If the manager is not capable of handling the job due to inadequate training or lesser intelligence, or if a high degree of coordination is needed between different functions of the firm--requiring information only the entrepreneur has--then the manager may make mistakes that could prove costly and that the entrepreneur could have avoided. If the entrepreneur fears that his managers will make mistakes, as the British appeared to do, then he will respond by limiting the authority of his managers. If the entrepreneur hires managers, he will restrict them to obeying orders and following preexisting routines and rules that limit their discretion. Thus the existence of a large bureaucracy does not necessarily mean authority is being delegated. But if improvements to the firm's procedures and structures are desired in terms of changes in

sales techniques, advertising, marketing, production methods, R&D, finance, internal organization, and strategic planning, either the entrepreneur will have to make decisions concerning the changes, despite his limited time and training or he will delegate that authority to someone else.

For some reason, the British had lower expectations of the value of delegating authority, though it is also possible that they did not want to share their authority with the lower ranks. It is not obvious which is the actual reason, but the consequences of the failure to delegate authority are fairly clear once the development of various British industries is analyzed and compared to the histories of foreign industries.

Lack of delegated authority thus hindered the growth of larger firms, particularly those that depended on balanced growth, while it did little damage to industries where small firms could flourish. When entry was easy and the optimal firm size was small, British industry was able to develop a high degree of sophistication in the marketplace, because of the tremendous entrepreneurial talent that was available, backed by wealthy capital markets. This sophistication created enormous external economies of scale, giving British industry significant advantages over its foreign competition. Small British firms generally were innovative and entrepreneurial.

However, in many industries there was a need for larger management structures, which were not forthcoming. British firms generally failed to achieve growth in more than one part of the firm. Growth depended on the field of expertise of the entrepreneurs in charge. If that field was critical to the success of the firm, and if the structures already set up in the firm or outside it in the marketplace were adequate, growth could be spectacular despite the weak entrepreneurship in complementary areas of the firm. An example of this is Lever Brothers' success, based on William Lever's marketing prowess. Despite his lack of investment in R&D or a rationalized management structure, he was able in a technologically stable industry to build a large empire in the soap industry [20].

Studies of the Electrical Manufacturing and Synthetic Dye Industries

Examination of the histories of the electrical manufacturing and the synthetic dye industries will provide stronger evidence that at crucial moments in the development of many industries, British firms' failure to delegate authority prevented them from attaining the kinds of growth that American and German firms were able to achieve. While past studies on the electrical engineering industry have emphasized the problems of electricity supply in Britain, the most serious area of backwardness has been in the manufacturing sector. By 1900 this sector was dominated by foreign concerns, with 59% of sales in of electrical machinery in 1907-1908 being produced by subsidiaries of foreign firms [4, Table 32]. British industry lagged seriously in the development of metal-filament lamps and in the use of alternating current [3, pp. 161-62]. The lack of R&D facilities in comparison to the large research departments created in the United States and Germany proved to be a serious problem for British manufacturing.

Yet the personnel were available in Britain to create a large British

firm, if anyone had been willing to put them together. Unlike the United States, where General Electric was consciously created from the merger of many firms, and Germany, where AEG and Siemens were building their internal organizations, Britian allowed its talented people to work in their own small, isolated firms and thus failed to take advantage of the economies of scope that exist when people with complementary abilities work together.

This left Britain vulnerable to the invasion of large American and German firms in the 1890s. By 1914, the British electrical manufacturing industry was dominated by foreign firms. Large efficiently run organizations were required both to produce and sell the equipment. Innovations had to be evaluated for technical and commercial efficiency; production models had to be developed, tested, and improved in reliability so that customers would want to use them, and a technically skilled sales force had to be trained and sent out to sell, install, and provide proper support for these systems. Not only was the industry rapidly changing in technology, but electrical systems were being built on a large scale. T. P. Hughes has described the firms of the electrical industry as system builders, because systems had to be built, with an eye toward technology and organization; construction was based on the product, an electrical power supply industry [9].

The British electrical industry did not suffer from lack of entrepreneurs or entrepreneurship. S. Z. de Ferranti was a genius who demonstrated tremendous technical ability, making major innovations in alternators, meters, high-voltage cables, AC distribution systems, switching equipment, transformers, and turbines. His failure to profit extensively from them illustrates how profiting from an invention requires more than a superior technology; it also requires a large, formal organization to exploit the technology and managers with authority to manage the different functions of the firm. There were many missed opportunities for expanding the firm during Ferranti's long career, including routinizing R&D, production, and finance. At one time Ferranti actually was losing money on his sales of steam alternators, despite the large numbers of orders he received. He insisted on delaying their delivery to his customers in order to make further improvements, in spite of stiff penalties for late delivery [21]. His technical genius was offset by his lack of commercial skill.

Charles Parsons was another remarkable inventor who preferred his independence to working within an organization. He invented the turbine, which had the potential of producing electricity at a cheaper cost than the standard reciprocating steam engines. Yet he failed to develop it further and switched to work on turbines used for steam propulsion, which entailed a new set of problems [4, pp. 192-93]. Like Ferranti, he failed to profit as much as he should have.

Other British firms in the electrical industry suffered from battles within the firm between commercial businessmen and the engineers. Crompton & Company, which had been successful in selling DC systems in the 1880s, had difficulties in the 1890s, particularly after Colonel Crompton turned his attention elsewhere. The businessmen then took control; they realized that potential profits had been wasted by the engineers, who had not paid enough attention to the commercial aspects of the firm. Their solution

was to appoint a general manager to be in charge of the business side, thus separating the two sides rather than promoting closer cooperation. The Electric Construction Company (or E.C.C.) suffered from similar difficulties. At first the inventor and engineer, Thomas Parker, had made important progress in the electrical railway market, using accumulators and high-voltage DC equipment. But financial difficulties arose, management was revamped, and the new board of directors cut back on experimentation. Parker was forced to resign; rather than stay on as consultant, he preferred to start his own company. The E.C.C. then produced a standard design without much R&D, which was profitable in the short run but eventually fell behind its foreign competition [4, pp. 190-92]. Thus British electrical firms seemed to find it necessary to choose between emphasizing innovation and commercial development, depending on who was in charge, while American and German firms maintained both.

One of the few commercially savvy British entrepreneurs in the electrical industry was Hugo Hirst, a German immigrant who joined a small supplier of electrical parts called G. Binswanger, later renamed General Electric Company, or G.E.C. His early success "was essentially due to his being first and foremost a salesman instead of a scientist or technical expert" [10, p. 73]. He went the unorthodox route of trying to make his goods more sellable to customers instead of worrying about the technical aspects. He then became involved in lamp manufacture and bought the rights to almost every important lamp invented, of which the osram lamp, made of tungsten, proved to be a popular product. Hirst appears to have been more ambitious organizationally and commercially compared to other British electrical firms, which accounts for G.E.C.'s relative success. He was very astute in spotting coming technological developments. However, he did not invest in R&D, the lifeblood of the industry, preferring to buy patents later. The G.E.C. did not do much manufacturing, except in lamps and heavy equipment, which, along with the company's lack of R&D, was probably a major factor in preventing it from growing much larger [4, 6].

Meanwhile, larger firms in the United States and Germany learned to delegate authority. Westinghouse created a large team of engineers to work on and solve problems that he helped define [17, pp. 131-38]. In the 1890s, General Electric had vice presidents in charge of sales, finance, and manufacturing, as well as a legal counsel. Four committees were set up to handle various problems, with a board of directors to provide some direction from stockholders and to monitor the firm's progress and finances, an executive committee of the board of directors to examine company operations on a closer basis, and a sales committee and a manufacturing committee to discuss problems and policies [16]. German firms too, namely Siemens & Halske and AEG, employed large organizations to do various tasks. Werner Siemens had some difficulty delegating authority, but the degree of organization and delegation was much higher than in the British electrical industry. Yet others, who delegated more authority and were quicker to build efficient organizations, were able to catch up to Siemens, specifically AEG, headed by Emil Rathenau. AEG was not family based as Siemens was, and Rathenau was not tied to a policy of promoting family members first. This

allowed AEG to catch up with Siemens in less than ten years. Siemens' policies changed when Werner retired in 1890; he was replaced by his son Wilhelm, who reorganized the firm, hired experts from outside, and created a staff at headquarters who screened information coming to his office [12].

Thus a larger, organizationally sophisticated firm was needed in Britain. Arguments in the past about decline in Britain have centered on the lack of scientifically trained personnel and on government interference in the electrical supply industry. Yet the market for electrical goods was large, and there certainly were enough personnel to staff a large firm. Ferranti, Parsons, Parker, and Swan (who was a coinventor of the incandescent light bulb) could have been involved in R&D. Crompton could have been in charge of production, Hugo Hirst could have handled long-range planning and development, and Charles Merz could have worked with the electrical supply customers to improve their efficiency and standardize the frequency they worked on. There was even a financier similar to Morgan available, Dudley Docker, who could have helped put together a larger firm as Morgan and Villard had done for General Electric [17, pp. 321-22].

The synthetic dye industry was invented in Britain in 1857 when British researcher William Perkin, while studying at the Royal College of Chemistry in London under the tutelage of August Hofmann discovered a synthetic dye he called aniline purple. The synthetic dye industry developed rapidly as Perkin developed methods of producing artificial colors and raw materials, applying the colors to fabrics, and selling the colors to the dyers. Other British researchers, most of whom were trained by Hofmann, such as Edward Nicholson and Henry Medlock, became involved in developing new aniline dyestuffs. The British and French came to dominate the market for synthetic dyes, which was rapidly growing because of the textile industry's need for cheap, colorfast dyes. By 1862, prospects for the British industry were so bright that Hofmann wrote that England would "beyond a question, at no distant day become . . . the greatest colour-producing country in the world . . . Bold as these anticipations may at present appear, precedents exist in abundance for their justification." Given the large textile industry in Britain, the abundant domestic supply of the basic raw material coal-tar, the results produced from Hofmann's researches, and the research and production activities of many of the domestic dye making firms, Hofmann's optimism seems well placed [2].

Yet decline in the British dye industry set in about 1873. The decline can be mostly attributed to the rise of the German dye industry. This was the critical time in the dye industry's development, when larger firms became more efficient in developing products and sales. There was also an important change in the effectiveness of British research methods. In 1869 Perkin discovered how to commercially produce synthetic alizarin, a substitute for the natural colors of madder and garancine, after the initial discovery of artificial alizarin in 1867 by Graebe and Liebermann in Germany. Unlike the aniline dyes, the new classes of alizarin dyes and azo dyes could yield new colors from systematic, careful research. Such study required trained chemists who were knowledgeable about the theory of organic dyes, and able to direct a team of researchers. When a new dye was discovered, all potential uses of it had to

be explored, and all methods of producing it had to be discovered to insure that the patents could not be evaded. While British and French firms held the early lead, the high quality of German R&D and the superior organization of German chemical firms allowed German industry to increase productivity quickly and reach out with a highly trained salesforce to potential customers, thus helping it to rapidly take over the market. The German proportion of world dyestuff production went from about 45-50% in 1881 to 80-90% in 1900. German output went up threefold over this period [11, pp. 77-80; 8, p. 167]. By 1913 Germany produced 85% of world output. Its output was twenty five times that of Britain's [18].

Britain's decline in this industry came about despite the many advantages British firms held. The cost of their inputs was generally lower than for German firms, since coal-tar came from British gas producers as a by-product. Much of the demand for the dyestuffs came from British textile firms, though French firms producing high-quality textiles for the luxury market were also looking for new colors. There were many chemists in Britain who were capable of researching new dyestuffs. While the German educational system was far superior, in general there were many British chemists who trained in German universities and then returned or who studied under Hofmann in London; many Germans also came over to Britain in the 1850s and 1860s to work in the British chemical industry, because German industry was still underdeveloped. Initially Britain's unique business culture had allowed it to achieve an early lead, for British researchers had been very aggressive in looking for commercial ways of producing dyes. Perkin was aware of the commercial potential of a new dye and seized his opportunity, even though Hofmann had tried to dissuade Perkin from pursuing commercial application of his discovery; unlike Perkin, he believed that scientific research was more important [2].

Britain's business culture prevented British firms from fully exploiting the discoveries they pioneered. British firms failed to set up larger organizations needed in the dye industry. If British entrepreneurs had been willing to hire managers and delegate authority to different divisions of the firm, they should have easily matched the growth of German firms. In the area of research, for example, British firms never invested in R&D as much as they should have. The British and German chemists they hired, German, were underpaid, often unappreciated, and given inadequate responsibility. Peter Griess is a case in point. He worked for Allsopp Ltd., a brewery, doing routine chemical analysis at low wages. Even though his discoveries of the azo dyes were very important for the industry, his research was only a hobby and was not used by his employers [2].

Many Germans returned to Germany in the late 1860s and 1870s. It is likely that many of them would have stayed with their British employers if the firms had made employment lucrative and interesting enough. Heinrich Caro, a German immigrant, was hired by Roberts, Dale and Co. to do some simple chemical analysis. His discovery of a process of printing aniline-black impressed the owners sufficiently to take him into partnership. After making a small fortune from his share of the business, Caro decided to return to academic research in Germany. Yet after much persuasion, BASF was able

to convince him to head its fancy new research laboratory [15, pp. 79-82]. Perkin also retired to do research in the late 1870s, though he continued to make important discoveries. A well-run British chemical firm could have given him his own laboratory and relieved him of the tedious responsibility of monitoring production and sales.

Thus it was not for lack of research talent that Britain suffered, but for lack of adequate employment. If Perkin had been offered a well-equipped laboratory in a large firm, he too may have stayed in the industry, as Caro did. The Germans essentially made Caro, Hofmann, and other researchers offers they could not refuse. Chemical firms even wooed academic professors--for whom "applied science" and "profits" were dirty words--with money, equipment, and a guarantee of academic freedom in order to use their discoveries and hire their students [2, p. 65]. Meanwhile, the British offered budding chemists employment as technicians at low wages with little responsibility. It is no wonder that the Germans returned to their homeland once the German chemical industry took off.

The investment in research was not the only area that allowed German dye firms to get ahead. They also invested heavily in their sales organizations with large sales staffs and consultants for their customers; they even agreed to train their customers' young employees in the art of dyeing. They paid close attention to different demands for certain colors and types of dyes, including China's and Russia's preferences for unusual hues and dyestuff. Their coloristic division tested dyes for applicability to all possible fabrics. In 1900, out of 3,500 potential dyes tested by Höchst, only 18 reached market [2].

Cultural Sources

The development of British industry and the causes of its decline can best be understood if we assume that the British did not delegate authority. Yet what are the possible reasons for their failure to delegate authority?

From an economist's point of view, it must be said that British entrepreneurs learned how to best run their firms from their environment, including the prevalent business culture. Thus, they employed suboptimal management techniques, because they expected that delegating authority would not be profitable. This expectation would have been reinforced by the weight of popular culture stressing the need to restrict authority to subordinates. Experimentation in delegating authority would have been difficult without extensive investment in people and training. Furthermore, attributing failure or success to poor delegation of authority would have been almost impossible because many other factors would have been the cause; it would also have been difficult for entrepreneurs to imagine how business could have been different within the British environment. (The last point is more easily perceived when one considers how poorly economic historians understand the root causes of the British economic decline.) In addition, the British may just have preferred not to yield authority.

Historically, the difficulties in delegating authority to those outside the family or outside one's clique or professional group have probably been due to a combination of the British tradition of individualism and of the class

system. The tradition of individualism had served the entrepreneurial sector well during the Industrial Revolution, leading to Samuel Smiles philosophy of "self-help". Meanwhile, the class system was reasserting itself in the late nineteenth century. The combination of the two meant that other classes and power groups would be watched with suspicion, hindering the delegation of authority as well as the industrial cooperation needed for development in areas like electricity supply.

Cultural factors must be considered as part of a complete cultural-economic system, because institutions, business culture, and economic growth all interacted and influenced each other. Institutions such as the educational system, the government, and the uniquely British system of consulting engineers were both influences on and affected by the structure of the British economy and entrepreneurs' preferred style of management. If entrepreneurs had been more willing to delegate authority, possibly there would have been more demand for engineers from the educational system, which the government would have supported, and less demand for consulting engineers to explain what system to buy.

Conclusion

It is hypothesized here that less delegation of authority in Britain helps explain many of the characteristics of British industry's development, especially those that differentiated it from industrial development in the United States and Germany. It has been shown that the reduced degree of delegation of authority affected business development in various ways. Firms were not able to exploit advances on separate fronts in industries with fast technological change, like the electrical industry. Building large systems was that much harder when the top leadership of the firm reserved for itself authority for making changes. Entrepreneurs who committed themselves to R&D found themselves unable to handle commercial problems in an efficient manner. When commercial people reorganized the firm and ensured that careful attention to costs was paid, their lack of understanding about R&D's necessity prevented the firm from keeping up with foreign competition in terms of technical quality. What was needed was a functional organization that could handle all aspects of the firm using managers and specialists. In many industries, balanced growth was needed to maintain competitiveness and steady growth. British firms tended to experience unbalanced growth, in which sharp advantages in one area could make up for weaknesses in other areas. In some circumstances this worked well, particularly in the introduction of radical but small-scale ideas, but in the newer industries British firms were at a disadvantage. Thus in the development of large systems, British firms found themselves usually unable to keep up with foreign competition. After initial advances, the systems were too large for one person to control and to build on technically.

Yet British industry was still very creative, especially at the individual entrepreneurial level. The notion of entrepreneurial failure should not be defined just in terms of a lack of entrepreneurs or their failure to take risks. It should also consider the structure and efficiency of the organizations they

built and worked in. An economy with numerous aggressive entrepreneurs and vigorous markets may still show the symptoms of entrepreneurial failure if its firms are unable to take advantage of potentially profitable opportunities for internal reasons. What may have been appropriate firm and market structures for the First Industrial Revolution were inappropriate for the industries of the Second Industrial Revolution. Perhaps much economic growth is driven by heroic entrepreneurs who are complemented by dutiful organization men. The latter may be less colorful, but they are no less important.

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