

7 The Diffusion of Scientific Management: The Bedaux Company in America and Britain, 1926–1945

By the time of Frederick Winslow Taylor's death, the gospel of industrial efficiency preached by American scientific managers was commonplace on both sides of the Atlantic. In the following years of world war, reconstruction, and adjustment, scientific management attracted a new generation of advocates and practitioners, many of whom would have perplexed and shocked Taylor and his immediate circle. Of the entrepreneurs of scientific management who succeeded Frank Gilbreth, Harrington Emerson, Richard Feiss, and other pioneers, none was more successful than Charles Eugene Bedaux (1886–1944). Unlike Taylor and his colleagues, Bedaux was and still is a mysterious figure. Secretive to a fault, he avoided professional contacts, refused to write for popular or technical journals, and spurned publicity. Yet he was a master salesman whose operations were global in scope and impact. Only in recent years, with the discovery of the papers of the British Bedaux Company, is it possible to gauge the impact of Bedaux and his extraordinary career.¹

Bedaux's success was based on simple insights that he and his engineers applied, apparently with little variation, in a variety of industrial settings. The Bedaux system brought the intellectual principles of scientific management down to earth from their lofty pedestal and put those principles into action. Table 7.1 indicates the growth of the international Bedaux consultancies between 1918 and 1931. According to a 1934 Bedaux publication, the Bedaux system had been used in twenty-one countries with nearly 100 applications in Britain and over 230 in the United States

TABLE 7.1

Breakdown of International Bedaux Offices, 1918-1931

Year	Number of Engineers	Plants Using Bedaux	Plants under Application	Total Plants
1918	2	1	2	3
1925	19	70	15	85
1926	41	110	35	145
1928	94	161	72	233
1929	114	278	68	346
1930	176	399	81	480
1931	205	509	123	632

Source: *Bedaux Measures Labor*, p. 9.

and Canada.² Bedaux's American clients included American Rolling Mill, General Electric, Standard Oil of New Jersey, Dow Chemical, Eastman Kodak, and Swift. Pierre Laloux estimated that by 1937, 500 American firms, 225 British, 144 French, 49 Italian and 39 Dutch firms had bought Bedaux's industrial services.³ Clearly, the Bedaux system commanded an international reputation during the 1930s that remained unchallenged by any other post-Taylorite system then available. Furthermore, by 1945 the British Bedaux Company had perfected a system of work measurement and labor management by which other similar systems were often judged.⁴

British managers became a particularly receptive audience to the Bedaux system during the late 1920s.⁵ Despite the highly publicized criticism of Taylor and Gilbreth in British engineering and technical journals, many British employers were nonetheless attracted to scientific management because of its promise of increased labor productivity without great investments in plant or machinery. Two diverse groups provide a rough measure of this potential. First were the personal efficiency experts such as Herbert Norris Casson, Edward Purinton, and T. S. Knowlson, who offered diluted yet passionate forms of scientific management in the guise of short, readable pamphlets and how-to manuals. These

manuals carried such titles as *How to be Healthy in Business* (1911), *How to Become Efficient: An Introductory Study of First Principles* (1914), and *Increasing Your Mental Efficiency* (1915). Regardless of how sophomoric or jejune these manuals may seem, the experts in efficiency helped sell the principles of scientific management to British managers.

Second, throughout the 1920s and 1930s, British industrial psychologists urged works managers and employers to experiment with workshop reorganization. New methods of reorganization took the form of job grading and analysis, time and motion study, vocational guidance and selection, and wage incentive schemes, the most popular and widely adopted being the premium bonus system.⁶ These methods were freely borrowed from the generation of British mechanical engineers who were influenced by Taylorian "science." Led by Charles S. Myers, founder of the influential National Institute of Industrial Psychology, the industrial psychologists professed to be critics of Taylor and Gilbreth and the engineers' approach to work.⁷ Yet by the 1920s, the psychologists' work came to signify nearly the same thing. Their language and techniques differed but their aims were quite close. The fact that the scientific manager aimed at "maximum" production and the industrial psychologist at "optimum" production ought not to obscure the significance of either of these two movements. The more the industrial psychologist tried to distance himself from Taylorism, the closer he came to embracing similar ideals. As paid consultants in industry, industrial psychologists helped to highlight the entrepreneurial quality of the scientific management movement as a whole.⁸

In such an atmosphere, Bedaux's system of labor management and work measurement became the most widely utilized system of scientific management in Britain.⁹ By 1945, more than 500 British firms had used the Bedaux System, including such industry giants as Joseph Lucas, Pilkingtons, Joseph Lyons, Ferranti, and Imperial Chemical Industries. Extensive applications were made in the chemical and allied trades, food processing, motor vehicle components (although not motor vehicles), textiles, and mechanical engineering. The appearance and success of the system, despite frequent managerial indifference and labor hostility, has led more than one historian to remark that the history of scientific management in interwar Britain is largely the history of Bedaux.¹⁰

Early Training

The Bedaux system was grounded in Taylor's scientific principles of work and management and in Harrington Emerson's twelve principles of "ethical" efficiency. This combination situates Bedaux well within the ranks of the American Taylorites. But what Bedaux added to the movement was his ability, unmatched by his contemporaries, to market and sell scientific management. As one of Bedaux's former British employers once remarked, Charles Bedaux was "the world's first true entrepreneur in scientific management."¹¹ Bedaux's first biographer, Janet Flanner, put it this way in 1945:

His genius was his promoter's faculty for making men want to believe what he said. He had a demagogic gift for convincing hardheaded businessmen that they were public benefactors, as he essentially believed he was himself. When some millionaire Scrooge in Chicago would frankly say that he was interested only in profits, Bedaux would tell him that he, the poor millionaire, was really interested in bettering man's conditions, in bettering himself, his community, his little Illinois world. The triple miracle of making the Scrooge believe this, buy the Bedaux system, and actually start bettering something besides his bank account was an accomplishment Bedaux pulled off so often that he dazed and even silenced his most critical employees.¹²

While personal efficiency experts and industrial psychologists struggled to impress and win over the sometimes obstinate employer with simple advice and scientific research, Bedaux was much more direct in his approach. Only practical and immediate results in terms of increased profits would impress the average executive. Bedaux promised and in most cases delivered lower unit costs, increased output, and greater efficiency.

Charles Eugene Bedaux was born at Charenton-le-Pont, Department of the Seine, on October 10, 1886.¹³ For the first sixteen years of his life Bedaux led a rather precarious existence on the streets of Paris, doing odd jobs and usually avoiding school. The details of his formal education are unclear and there is no record of his having received a regular degree. The young Bedaux found

work in a bookstore and in a quarry, where his biographer, Jim Christy, says he first began to analyze motions and various work procedures.¹⁴ Early in 1906, the twenty-year-old Charles Bedaux left France and emigrated to the United States where he found work as a dishwasher, sandhog with the crews building the Hudson River tunnels, and insurance salesman. He also worked a short stint at the New Jersey Worsted Mills in Hoboken. It seems unlikely that such a meager training would have prepared Bedaux for a successful career as an industrial engineer, but between 1909 and 1916 Bedaux conceived and perfected his own system of scientific management.

In 1909, Bedaux found employment in the clerical department of the Mallinckrodt Chemical Company of St. Louis. He noted that inefficient production was due to a lack of common sense on the part of management. An efficiency engineer was secured to do time studies. Bedaux studied the work of the efficiency expert and concluded that the expert had accomplished very little. Bedaux brought his findings to the attention of management and was himself promoted to efficiency expert.¹⁵ The following year, Bedaux was introduced to Wilfred Sellers, who was then President of the Sellers Kitchen Cabinet Company of Ellwood, Indiana. The Sellers organization was proud to have devised a new approach to the "traditional kitchen" and stressed greater efficiency by the better arrangement of tabletops and appliances.¹⁶ Sellers and Bedaux became close friends, and Sellers told a number of his friends in the Grand Rapids area about Bedaux. It was at this time that Bedaux began to conceive his system while engaged as an individual consultant for several furniture companies.¹⁷

After a brief trip to Paris in 1912, Bedaux returned to the United States as consultant for the McKesson & Robbins Company of New York. It was at McKesson & Robbins the following years that Bedaux was introduced to A. M. Morrini, an Italian industrial engineer who came to the United States to investigate scientific management. Morrini left for France with three Emerson engineers and Bedaux was secured as an interpreter for the group.¹⁸ After his contract with Morrini ended, Bedaux worked with L. B. Duez, advising furniture factories in Paris, and automobile and airplane factories at Agenteuil. It was also at this time, according to Christy, that Bedaux read Taylor, Emerson, and other scientific management writers.¹⁹ Bedaux supposedly developed his own

system at a direct reaction to Taylor's work. He rejected Taylor's approach to "Schmidt" and proposed that a more equitable method of measuring labor could be developed.²⁰ The result was the Bedaux work unit, or *B*, which will be discussed in the next section.

By 1914, Bedaux was confident that he could compete successfully with the leading consultants. With the outbreak of war he served briefly in the Foreign Legion, then returned to the United States where he worked as Morrini's assistant at the Wolverine Brass Company of Grand Rapids. Bedaux broke his contract with Morrini and with financial backing from a sales executive, Frederick Brearly, formed the Charles E. Bedaux Company of Cleveland.

A training manual that he published shortly thereafter, *The Bedaux Efficiency Course for Industrial Application*, reflects his debts to Taylor and Emerson.²¹ For Bedaux, efficiency was the science that teaches the best way to produce the maximum result with minimum effort; it is logic, common sense, and the concentration of effort. "Efficiency applied to industry, scientific management," Bedaux wrote, "is not an occult science but it is, on the contrary, an elementary, organized, classified knowledge within the reach of all."²² Bedaux realized that efficiency was something new and vital. "Is efficiency a new science?" he asked. "When was it born and why was it born? Why do we see the word written and spoken everywhere, while a decade ago, although in the dictionary, it was practically unknown to humanity? What is efficiency?"²³ In a series of object lessons, admonitions, and case studies, Bedaux diagnosed modern industry and offered his solution to the world.²⁴

The Bedaux System

The Bedaux system was a labor management control system founded on the premise that all human labor could be measured in terms of definite units of effort and fatigue. Bedaux claimed to have solved the problem that plagued the Taylorites, namely the precise, scientific relationship between effort and fatigue. Bedaux identified a unit of work, which he called the *B* and defined as "a fraction of a minute of work plus a fraction of a minute of rest, always aggregating unity, but varying in proportions according to the nature of the strain."²⁵ Of course, the discovery that an hour of work contained sixty units of effort combined with rest should

hardly surprise us, but with this revelation Bedaux believed he had stumbled upon a fundamental law in the science of work. This law he proudly called the “principle of human power measurement.”

Bedaux used time and motion study, which he called “work study,” to produce an elaborate chart of effort and relaxation values.²⁶ All tasks were assigned a specific *B* rating, and from this rating the Bedaux engineer could determine the proper rate of remuneration according to the skill, experience, and responsibility required of a specific job. The average worker, working under average conditions, with a sufficient supply of raw materials and with machinery in good repair should have been able to reach an output of 60Bs per hour (Normal Performance Level). However, the Bedaux engineers regarded a standard of 80Bs (Standard Performance Level) as being entirely possible, especially where labor, process, and management were 100 percent efficient. According to J. A. Edwards, Bedaux engineer at the short-lived application at J. R. Freeman & Son,

The attainment of an 80 unit hour is rendered possible not by an increase in the operator’s speed of working, but by the removal of certain unnecessary elements in the operation, by better arrangement of working materials, by adequate servicing, and by the analysis and elimination of the cause of lost time.²⁷

Bedaux himself reasoned that “less than 80Bs a hour” indicated the “incomplete use of labor and incomplete realization of maximum earning power.”²⁸ The bonus for each premium *B* was one-sixtieth of the base rate of wages, and Bedaux recommended that 75 percent of the bonus be paid to the worker and the remaining 25 percent to supervisors and indirect workers whose labor facilitated production in excess of the 60*B* standard.²⁹

The determination of wages under Bedaux’s system was a complicated affair, which often confused workers as much as it did works managers. The Bedaux organization was aware of this tendency, and in the late 1920s and early 1930s produced short handbooks designed to explain the calculation of wages.³⁰ Its distinctive jargon aside, the Bedaux method closely resembled L. H. Gantt’s “task and bonus” system. It was based on preliminary improvements in plant organization and working conditions (though not the comprehensive reorganization that Taylor fa-

vored), the use of time studies to establish standards, and a guaranteed base rate regardless of output.³¹ Individual performance was measured through the aggregate number of *Bs* produced. At the end of each shift, the worker's total number of *Bs* were tallied, and posted the following day. The Daily Posting Sheet showed the hours worked and the *B* or "point hour" attained. Daily premium wages were also posted so the worker could check his performance and determine his wages. Wages were paid in two envelopes, one containing base wages, the other containing the premium earned. In this way, "an atmosphere of prosperity is . . . produced that twice the amount given in the same envelope in the form of a raise would not create."³² In addition, each department head received a consolidated Weekly Analysis Sheet showing the performance of all operators and the average point hour attained for specific departments (see table 7.2). The "Reference *B* Hour" refers to the *B* rating before the Bedaux system was installed. In nearly every case, the Reference *B* hours were surprisingly low.

Such were the fundamentals of the Bedaux system. Bedaux engineers would enter the factory and over a period of three or four weeks conduct countless work studies in order to measure current efficiency and show how and where inefficiencies could be rectified by the more rational organization of machines and labor. Every evening the engineer had to prepare a detailed report outlining the progress of his work, which he submitted to management the following day. He also sent copies of his reports, with recommendations, to London where they were carefully reviewed by Bedaux's Technical Department.³³ The reports pointed out to management the amount of savings that could be expected over any projected period of time. This was part and parcel of Bedaux's sales pitch: the only way the engineers could overcome employer obstinacy and hesitancy was to confront them with immediate profits. If the Bedaux Archives reveal anything, it is that works managers and employers were literally bombarded by statistical evidence that their factories could be run much more efficiently.

Bedaux engineers reorganized machines, adjusted feeds and speeds, constructed new conveyor systems, and in many cases urged employers to invest in new and sometimes costly machinery. For instance, during a ten-month application at Cooper's & Co., a Glasgow manufacturer of biscuits, Bedaux fees were

TABLE 7.2

Sample Bedaux Weekly Analysis Sheet (1929)

Operation	Reference B Hour	Daily B Hours						Average
		T	F	S	M	T	W	
packing	32.9	50	43	58	54	60	66	55.2
soldering	18.7	29	46	54	43	42	46	43.3
nailing	32.0	39	49	53	39	38	54	44.3
wire/attach seal	24.2	40	40	51	35	36	42	40.1
nail cases	15.9	19	13	29	13	13	—	17.4
truck cases	27.4	32	30	38	27	28	32	31.2
weighing	17.5	39	35	39	33	38	36	36.6
cutting hoop	18.8	43	43	49	43	43	40	43.5
strapping	33.0	38	40	51	45	57	60	48.5
nail strapping	29.9	50	40	53	43	49	60	49.1
reverse cases	11.5	32	30	37	31	28	28	31.0
truck to lorries	17.4	31	29	35	31	27	27	24.8
AVERAGE:	23.2	37	37	46	36	38	45	39.8

Source: Bedaux Archives, British-American Tobacco Co., Ltd., March 7, 1929, Film 3G.

reckoned to be in excess of £3,000. Upon the recommendation of the Bedaux engineer, a further £12,000 was invested in new machinery. Wage costs also increased by £5,000 per year. The net effect of the application was that, at the end of the period, the firm was losing about £2,000 per year.³⁴

The Bedaux organization nevertheless proclaimed that any firm could expect annual savings of up to 35 percent, and in some cases would save even more. Unit costs would decrease by 20 percent and wages would increase by 15 or 20 percent. Management would gain valuable experience and be prepared to reorganize other departments as the need arose.³⁵ Laborers would come to expect the increased earnings promised by the Bedaux engineers and gladly better their performance. "The main point to be mastered," as Bedaux himself once wrote, "should be the placing of labor in a frame of mind such that everyone grows to believe the efficiency man wishes nothing but good to the worker."³⁶

The whole process of Bedaux applications was, at least when compared with other systems, extremely rapid. From 1926, the

year that Bedaux opened his London office, until 1948, more than 46 percent of a total of 606 British applications were completed in twelve months or less.³⁷

Bedaux in Britain, 1926–1945

The response to the introduction of the Bedaux system in Britain by labor and management was both varied and outspoken. While the British Bedaux company continued to attract a lengthy list of clients throughout the 1930s and 1940s, both managers and workers frequently expressed their hostility toward the system. Numerous works managers and foremen saw the Bedaux system as a direct assault upon their authority. They often reacted to the introduction of the system with sabotage, exposing the carefully conducted work studies of the Bedaux engineers as incorrect and unscientific. Workers reacted more sharply and deliberately. Work stoppages and strikes against the introduction of the system were numerous during the 1930s. Between 1929 and 1939, thirty-six work stoppages and strikes against the Bedaux system were reported to the Chief Conciliation Office of the Ministry of Labour. Strikes were most frequent in the chemical and allied trades, engineering, and the textile industry. In twenty-eight strikes for which reliable information is available, the average duration was twenty days. Twelve strikes lasted between thirty and sixty days, and strikes at Boulton & Paul (1931) and Richard Johnson & Nephew (1934) persisted for more than four months.³⁸ While the majority of these strikes were precipitated by Bedaux time studies, agitation by Communists also added to the overall hostility exhibited by the British worker toward Bedaux. The Trades Union Congress (TUC) and General Federation of Trade Unions (GFTU) issued independent reports on Bedaux and resolved that their members fight the system to a standstill.³⁹ Where Bedaux could not be defeated, the TUC recommended that their members work to modify the system. Yet despite such suspicions and fears, Bedaux continued to attract even more clients as the years passed.

By 1948, the Bedaux system was well known in British industrial management circles and had been installed in more than six hundred firms with varying degrees of success. As table 7.3 indicates, by the 1930s an average of twenty-five new clients were

being added every year. Nearly half of the applications before 1939 were in food processing, chemical and allied trades, and textiles, but after the outbreak of World War II, metal manufacture, mechanical engineering, and textiles made up about 60 percent of Bedaux's business in Britain (see table 7.4). These figures call for further comment. First, it was rare that an entire plant was totally reorganized by Bedaux engineers. Second, there are a few instances in which applications were not conducted by Bedaux engineers. Instead, works managers learned of the system through their contact with other managers and applied what they thought was the Bedaux system. In such cases the system usually ran aground because the firm's engineers were not trained in Bedaux methods. In the hands of "foolish or avaricious employers," such a development helped Bedaux earn an even poorer reputation among British workers.⁴⁰

British workers argued that the Bedaux system was antisocial and contrary to the principles of trade unionism. Percy Glading, a prominent leader of the London engineering workers, bitterly complained that the Bedaux system "has succeeded in increasing production in various industries where other well-known systems of payment by results, bonus systems, straight piecework systems, and similar swindles have been less successful."⁴¹ Horace Moulden wrote of Bedaux that "this system . . . promises to become a great factor in the path of trade unionism."⁴² "That hellish system," and "absolutely ridiculous" were phrases used by British workers in the 1930s to describe the system. Even the name "Bedaux" came to symbolize an attempt on the part of management to increase the speed of production and cut established rates. For this reason, the British Bedaux office soon cautioned its engineers not to use the name of Bedaux while on assignment. When William Smyth, a Bedaux engineer, was assigned to Joseph Lucas in 1938, he was requested "not to mention the name Bedaux at any time at . . . [the] Works. This is a matter of policy we have determined from a point of view of labour relations and is most important."⁴³ By the late 1930s, Bedaux terminology was also altered to quiet opposition. The Bedaux Office became the Bonus and Control Office, Premium Hours became Bonus Hours and the *B* Hour was simply referred to as Performance. Finally, the great symbol of the system, the *B*, was replaced by less obnoxious terms such as the Allowed Minute (*AM*) or Point (*P*).⁴⁴

TABLE 7.3

Number of British Firms Using the Bedaux System
by Year, 1926-1948

1926	3	1932	29	1938	22	1944	20
1927	4	1933	15	1939	24	1945	31
1928	5	1934	27	1940	23	1946	33
1929	9	1935	16	1941	18	1947	44
1930	13	1936	11	1942	26	1948	31
1931	30	1937	22	1943	21		

Source: Bedaux Archives, Organization Charts, Films OC 1-6.

TABLE 7.4

Distribution of the Bedaux System in Britain by
Industrial Sector, 1926-1949

Trade Group	Number of Firms Using Bedaux	
	1926-1939	1939-1949
Food, Drink and Tobacco	22	13
Chemical and Allied Trades	26	28
Coal and Petroleum	3	2
Metal Manufacture	18	42
Mechanical Engineering	10	57
Electrical Engineering	9	6
Motor Vehicle Components	8	1
Textiles	36	115
Services/Distribution	11	58
Other	35	66
TOTAL	178	388

Source: Bedaux Archives, Organization Charts, Films OC 1-6.

Nevertheless, by the 1940s, Bedaux's work study techniques had become the standard by which other systems were measured. The British Bedaux office trained numerous work study engineers, many of whom either went on to open their own management consultancies or who created work study departments within specific firms. For instance, former Bedaux engineer Leslie Orr

left the British office in 1932 and joined British scientific management devotee Lyndall Urwick to form Urwick, Orr & Partners.⁴⁵ Two years later, R. Bryson and W. H. Craven left Bedaux and together established the P. E. Group, and in 1943 E. E. Batten left Bedaux and set up Personnel Administration Ltd. Americans Frank Mead and Colwell Carney left the British office in 1938 and returned to the United States. After World War II they were both back in Britain and together established Mead, Carney & Partners, a management consultancy specializing in work measurement techniques.⁴⁶ Bedaux engineers often remained at individual factories where they created their own work study departments, such as at Imperial Chemical Industries. By the late 1930s, similar developments were under way at Pilkingtons, Kodak, and Joseph Lucas. According to William Smyth, "in the field of work measurement, and particularly, of time study, present day practice probably owes more to Bedaux than to Taylor."⁴⁷

Conclusion

The career of Charles E. Bedaux underlines the possibility of "a brilliant campaign of salesmanship" in an industrial world sensitized to the possibilities of rationalized production.⁴⁸ Bedaux had no original ideas or special insights into industrial management; he offered no more than had a score of competitors in the 1920s and 1930s. By the standards of Taylor, his immediate followers, and his intellectual heirs in the Taylor Society, Bedaux was little more than a quack or charlatan. Yet by the 1930s he had become a leading practitioner of scientific management on both sides of the Atlantic. Indeed, Bedaux's international reputation probably surpassed that of Taylor, Gilbreth, and their most orthodox disciples. Bedaux succeeded because his clients had already been educated to the potential of scientific management and because his approach was simple, logical, direct, and, from the executive's perspective, highly appealing. Unlike Taylor, Gilbreth, and others, he did not demand new investment, radical changes in management systems, or a long transitional period; a "mental revolution," if it occurred at all, was an incidental feature of a Bedaux reorganization. Bedaux nevertheless promised increased output and lower unit costs, largely at the expense of the workers' mental and physical health. His efforts boldly emphasized the narrow line

between the highminded theorists, who offered workers a better life via planning, system, and order, and less exalted efficiency engineers who offered marginally higher wages for substantially greater effort.

Was the British experience typical? Until more is known about the activities of Bedaux's American, French, Italian, German, and other European and global agents, it is impossible to be certain. British employers on average devoted more attention to labor costs and the possibilities of reducing those costs. The meager record that survives suggests that American managers of the interwar years were receptive to simple, nondogmatic appeals and were cognizant of the possibilities of the Bedaux system. Certainly there is no evidence that Bedaux suffered in the competition for their attention. The handful of references that have come to light suggest that Bedaux's approach was similar everywhere and that American managers and workers who were employed by firms that hired Bedaux had many of the same complaints as their British compatriots. In America as well as in Britain, the Bedaux Company insured that the controversies that had marked the early years of the scientific management movement did not disappear altogether.

NOTES

1. For biographical details of Charles Bedaux, see Janet Flanner, "Annals of Collaboration: Equivalism," *The New Yorker* (September 22, October 6 and 13, 1945), pp. 28-41, 32-43, 32-47; Jim Christy, *The Price of Power: A Biography of Charles Eugene Bedaux* (Toronto, 1984); Steven Kreis, "The Diffusion of an Idea: A History of Scientific Management in Britain, 1890-1945," (Ph.D. diss., University of Missouri-Columbia, 1990), chaps. 5 and 6.
2. For a list of Bedaux's American clients see the unpublished International Bedaux Company's *Representative List of All Bedaux Companies* (New York, 1934). Bedaux's work in the United States has received little attention, but see Jeremy Egolf, "The Limits of Shop Floor Struggle: Workers vs. the Bedaux System at Willipa Harbor Lumber Mills, 1933-35," *Labor History* 26 (Spring 1985), pp. 195-229. David Montgomery refers to Bedaux as a "scientific manager" and "French Taylorite" in his *The Fall of the House of Labor: The Workplace, the State, and American Labor Activism, 1865-1925* (Cambridge, England, 1987), pp. 87, 440. See also John Purcell, *The Worker Speaks His Mind* (Cambridge, 1953), chap. 11; L. C. Morrow, "Application of Bedaux Management Methods in the Robbins & Meyers Plants," *American Machinist* 57 (August 17, 1922), pp. 249-55, 294-98.

3. Pierre Laloux, *Le Système Bedaux Calcul Des Salaires* (Paris, 1951), p. 11. Similar figures can be found in Spencer Miller, Jr., "Labor's Attitude Toward Time and Motion Study," *Mechanical Engineering* 60 (April 1938), pp. 289-94, 338; and Harlow S. Person, "The Bedaux System," *New Republic* 93 (November 24, 1937), p. 17.
4. See, for example, Sylvia Shimmin, *Payment By Results: A Psychological Investigation* (London, 1959); and the scattered references to Bedaux in two reports issued by the Dartnell Corporation, *Job Evaluation Methods and Procedures*, Report no. 531 (Chicago, 1945); and *Experience of 117 Companies with Wage Incentive Plans*, Report no. 561 (Chicago, 1948). See also the British Productivity Council reports, *Cutting Costs for Productivity* (London, 1958); and *Work Study in the West* (London, 1958). Bedaux work study is also reviewed in the National Industrial Conference Board's report, *Systems of Wage Payment* (New York, 1930); and the International Labour Office handbook, *Payment By Results* (Geneva, 1951).
5. The literature on British economic performance in the interwar years is immense, although the role of scientific management in British industry has been neglected. See, for instance, Derek Aldcroft, "The Performance of British Machine-Tools in the Interwar Years," *Business History Review* 40 (Autumn 1966), pp. 281-96; Sidney Pollard, *The Development of the British Economy, 1914-1950* (London, 1962); Peter L. Payne, "Industrial Entrepreneurship and Management in Great Britain," in Peter Mathias and M. M. Postan, eds., *The Cambridge Economic History of Europe*, vol. 7, part 1 (Cambridge, England, 1978), pp. 180-230; Jonathan Zeitlin, "The Emergence of Shop Steward Organization and Job Control in the British Car Industry: A Review Essay," *History Workshop* 10 (Autumn 1980), pp. 119-37; William Lazonick, "Industrial Organization and Technological Change: The Decline of the British Cotton Industry," *Business History Review* 57 (Summer 1983), pp. 195-236. Two other works of interest are A. L. Levine, *Industrial Retardation in Britain 1880-1914* (New York, 1967); and Martin J. Weiner, *English Culture and the Decline of the Industrial Spirit, 1850-1980* (Cambridge, England, 1981).
6. The premium bonus system (PBS) was a payment by results scheme whereby workers were paid a bonus for producing above a standard output. The PBS substituted a time allowance for a piece work price. Initially, output was determined by foremen but by 1900 rate fixers had assumed the responsibility for determining rates. The literature on the PBS in Britain is extensive but see, David F. Schloss, *Methods of Industrial Remuneration* (New York, 1892); G. D. H. Cole, *The Payment of Wages: A Study in Payment By Results Under the Wage System* (London, 1918); J. A. Hobson, *Incentives in the New Industrial Order* (New York, 1925); William Graham, *The Wages of Labour* (London, 1921). For an excellent survey of the PBS in the engineering industry see James B. Jeffreys, *The Story of the Engineers 1800-1945* (London, 1946).
7. Charles S. Myers, *Mind and Work: The Psychological Factors in Industry and Commerce* (London, 1920), p. 23.
8. The institutional implications of British industrial psychology and scientific management are explored at length in D. C. Doyle, "Aspects of the Institu-

- tionalisation of British Psychology: The National Institute of Industrial Psychology 1921-1939" (Ph.D. diss., University of Manchester, 1979). On American industrial psychology, see the useful but dated work by Loren Baritz, *The Servants of Power: A History of the Use of Social Science in American Industry* (Middletown, CT, 1960).
9. The Bedaux system was not the only scheme of scientific management to have emerged in the interwar period. Numerous systems of wage incentives and workshop reorganization flourished in Britain after the 1890s: some developed out of the British engineering workshop (eg. the Weir, Rowan, Mavor and Priestman-Atkinson systems), while others had been imported from the United States. This influx of systems and their subtle modifications was as much a product of the British engineering workshop experience as it was a transatlantic dialogue between engineers and works managers.
 10. Craig Littler, *The Development of the Labour Process in Capitalist Societies: A Comparative Study of the Transformation of Work in Britain, Japan and the U.S.A.* (London, 1982), p. 108; P. Livingstone, "Stop the Stopwatch," *New Society* (July 10, 1969), p. 49.
 11. Mildred Brownlow to the author, January 17, 1987. Brownlow worked in the Technical Information Department and Library at Bedaux's London office from 1926 to 1972. I am indebted to this extraordinary woman for supplying me with numerous details of some of the finer points of the system and the company.
 12. Flanner, "Annals of Collaboration," (September 22, 1945), p. 30.
 13. The biographical details that follow are taken from Christy, *The Price of Power*. See also the unpublished and informal history of the Bedaux companies, "History of the Bedaux Companies and Albert Ramond and Associates, Inc., 1910-1955." This document was kindly sent to me by Elizabeth A. McDonough of Albert Ramond and Associates (Chicago). Albert Ramond was a close friend of Bedaux's and was selected by Bedaux to direct several American offices. By 1938, however, thanks to some personal intrigues between Bedaux's son and Ramond's wife, Ramond led a palace revolt against Bedaux and subsequently took total control of all the American Bedaux companies.
 14. Christy, *The Price of Power*, pp. 12-13. Records of the youthful Taylor reveal a similar preoccupation. See in particular, Sudhir Kakar, *Frederick Winslow Taylor: A Study in Personality and Innovation* (Cambridge, MA, 1970).
 15. Christy, *The Price of Power*, pp. 23-25.
 16. See the lengthy section on mechanization and the twentieth-century household in Siegfried Gideon's seminal essay, *Mechanization takes Command: A Contribution to Anonymous History* (New York, 1948), pp. 512-606.
 17. The account of Bedaux's friendship with Sellers is related in "History of the Bedaux Companies," p. 1. Christy does not mention this episode in his biography.
 18. Charles Lytle, *Wage Incentive Methods: Their Selection, Installation and Operation* (New York, 1942), p. 224n. See also Christy, *The Price of Power*, pp. 27-28.
 19. Christy, *The Price of Power*, p. 28.

20. See Charles D. Wrege and Amedeo G. Perroni, "Taylor's Pig Tale: A Historical Analysis of Frederick W. Taylor's Pig-Iron Experiments," *Academy of Management Journal* 17 (March 1974), pp. 6-27. See also Reginald Marriott, *Incentive Payment Systems: A Review of Research and Opinion* (London, 1957), p. 338.
21. *The Bedaux Efficiency Course* was initially published by the Bedaux Industrial Institute in 1917, and a revised edition with the cover title "Industrial Management" appeared in 1921. The manual was used extensively in Britain and the United States throughout the 1920s, and was then replaced by the following manuals: *Code of Standard Practice* (1928), *Code of Application Principles* (1930), *Training Course for Field Engineers* (1930), and *Standard Bedaux, Weekly Analysis Sheet: Notes on Use* (1933).
22. Bedaux, *The Bedaux Efficiency Course*, p. 12. This is the only direct reference Bedaux made to scientific management. Elsewhere he discusses a "scientific form of management" (p. 70) and the "science of efficiency" (p. 108).
23. Bedaux, *The Bedaux Efficiency Course*, p. 2.
24. The discussion that follows is based on a detailed analysis of the Bedaux Archives. The archives are located at the Business Office of INBUCON Management Consultants Ltd., near Haywards Heath, West Sussex, Great Britain. The files consist of several thousand reports documenting Bedaux's work with British clients from 1926 to the present. Although extremely repetitive, this extensive collection provides a complete picture of the daily operation of the Bedaux system from the standpoint of the Bedaux engineers. Craig Littler was the only other scholar to have used these records, although he failed to cite their location in his published works. I am indebted to D. M. Wilford and Sandra Silke of the London Office and Sheila Fernee at Haywards Heath for granting me permission to use this important collection. None of my research would have been at all possible had it not been for Howard Gospel of the Business History Unit of Economics, for helping me to discover the location of the Bedaux Archives.
25. Charles E. Bedaux, *Bedaux Measures Labour* (London, 1928), p. 3. See also L. C. Morrow, "The Bedaux Principle of Human Power Measurement," *American Machinist* 56 (February 16, 1922), pp. 241-45.
26. All efforts to locate this chart have been fruitless. I have contacted former Bedaux engineers, management consultants, and management historians in both Britain and the United States regarding this chart and none have any recollection of its existence. We can only surmise that this curious chart was the product of Bedaux's own observations rather than "scientific objectivity." British trade unionists and other critics of Bedaux were always quick to point to this singular failure of the system as a whole. It is perhaps possible that this chart was a clever bit of salesmanship on the part of Bedaux. Regardless, the discovery of this chart would reveal a great deal about Bedaux's claim to have produced a science of work.
27. Bedaux Archives, J. R. Freeman & Son, September 22, 1934, Film 19D.
28. Bedaux, *Bedaux Measures Labour*, p. 5.
29. By the late 1930s, the 75 percent bonus for direct workers was changed to 100 percent owing to increased trade union demands made upon manage-

- ment. In the United States, this important modification took place somewhat later, in the 1950s. See Purcell, *The Worker Speaks His Mind*, p. 237.
30. See, for instance, Hoffman Manufacturing, *The Bedaux Method of Wage Payment* (1928); Hayes Cocoa, *The Bedaux Method* (1931); Venesta, *The Bedaux System* (1932).
 31. See F. A. Halsey, "The Premium Plan of Paying for Labor," *Transactions: American Society of Mechanical Engineers* 22 (1891). See also William B. Cornell, ed., *Organization and Management in Industry and Business* (New York, 1928), pp. 274–88; and NICB, *Systems of Wage Payment*, pp. 55–64.
 32. Bedaux, *The Bedaux Efficiency Course*, p. 292.
 33. These daily reports were extremely detailed and were about ten pages in length. The London office became so swamped by this mass of statistical and technical data that by the late 1930s it urged engineers to submit one or two reports per week. By the early 1940s, the reports were filed once or twice per month.
 34. Report of J. B. Galbraith, Glasgow Chief Conciliation Officer, Ministry of Labour, October 3, 1935, Public Record Office, Ministry of Labour, Industrial Relations Department, LAB 2 2061/1, Ref. IR(G) 105/1/1934. See also Bedaux Archives, Cooper & Co, Film 19C.
 35. Integral to the smooth operation of the Bedaux system was the selection of several workers to serve as time study trainees. This was necessary so that Bedaux's work could be continued after the assignment was terminated. One key to the system was maintenance, and the time study practitioners served just such a purpose. They also acted as liaison between the Bedaux engineer, fellow workers, and management.
 36. Bedaux, *The Bedaux Efficiency Course*, pp. 186, 188.
 37. Bedaux Archives, Organization Charts, Films OC 1–6. Applications that lasted more than five years represented almost 24 percent of the total number of firms where the Bedaux system was installed.
 38. The dispute at Richard Johnson & Nephew between 1932 and 1934 is well documented. On the dispute, see "Bedaux Dispute at Richard Johnson & Nephew, 1932–1934," a file located at the Working Class Movement Library in Old Trafford, Manchester. See also Mick Jenkins, "Time and Motion Strike—Manchester 1934–7: The Wire drawers' Strike Against the Bedaux System at Richard Johnson's," *Our History* 60 (Autumn 1974), pp. 3–34; Littler, *Development of the Labour Process*, pp. 128–40. Unfortunately, there are no records of the Bedaux applications at Richard Johnson in the Bedaux Archives because the film on which they are located (Film 16) is now missing.
 39. See Trades Union Congress, *The TUC Examines the Bedaux System of Payment By Results* (London, 1933); General Federation of Trade Unions, *Report on the Bedaux and Kindred Systems* (London, 1932).
 40. See GFTU, *Report on the Bedaux and Kindred Systems*, p. 2.
 41. Percy Glading, *How Bedaux Works*, Labour White Paper, no. 45 (London, 1934), p. 4.
 42. Horace Moulden, "Interim Report on the 'Bedaux System of Labour Measurement,'" March 2, 1931, Public Record Office, Ministry of Labour,

- Industrial Relations Department, LAB 2, File 2060/5, Ref. IR(Bi) 73/1. Moulden was Secretary of the Leicester Amalgamated Hosiery Workers' Union and key figure in the lengthy strike by Wolsey workers against Bedaux in 1931. See also Littler, *Development of the Labour Process*, pp. 118-28.
43. Norman Pleming to William Smyth, April 6, 1938. This letter was kindly sent to me by Willie Smyth.
 44. Bedaux Archives, Linoleum Manufacturing Co., June 19, 1948, Film 26D.
 45. See the short prospectus prepared by Urwick, "Profit on Principle: A British Service for British Business in the Application of the Principles of Direction and Control," (London, 1934). Urwick mentions Taylor, Emerson, Gilbreth, Gantt, and Fayol, but Bedaux's name is curiously absent.
 46. Mead and Carney were originally sent by Bedaux to Britain to open the London office in 1926. Both men had trained under Bedaux at several firms in the Rochester, New York area. Their earliest assignments in Britain were at the Wealdstone plant of Kodak and at Goodrich Rubber.
 47. William A. Smyth, "Bedaux—The Man and His Work," *Work Study* (October 1966), p. 7.
 48. Edwin T. Layton, Jr., "The Diffusion of Scientific Management and Mass Production From the U.S. in the Twentieth Century," *Proceedings of the XIVth International Congress in the History of Science 4* (Tokyo, 1974), p. 383.