

The Centennial of Frederick W. Taylor's *The Principles of Scientific Management:* A Retrospective Commentary

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The centennial of The Principles of Scientific Management (PSM) provides an opportunity to reflect on Frederick W. Taylor's best known work. Taylor remains at the top of the list of those who have contributed to the history of management thought and PSM is considered the most influential management book of the 20th century. Those first attracted to the writings of Taylor were engineers who had seen his experiments and publications appear in the transactions of the American Society of Mechanical Engineers, who had read his first book, Shop Management. The events leading to the appearance of PSM are much lesser known and will be examined to aid in explaining how Taylor's preferred term for his work, task management, became scientific management. Finally, how scientific management became an international force, stimulating thought and development in numerous countries beyond the U.S will be discussed.

Would an author of today find a publisher for a book that advocated the conservation of our natural resources because “We can see our forests vanishing, our water-powers going to waste, our soil being carried by floods to the sea; and the end of our coal [and oil] and iron is in sight? But our larger wastes of human effort . . . is greater than from our material things, the one [natural resources] has stirred us deeply, while the other [human resources] has moved us but little” (Taylor, 1911, preface). These issues have many contemporary names, but our Nation and the World continue to encounter the problems of that period in which Frederick W. Taylor wrote those words. Taylor's

solution was better management of our natural human resources and he provided ideas that still endure today.

The intriguing question is why Taylor and his ideas maintained a continuing grip on the management literature and our current thinking? One example illustrates how his influence continues. A contemporary, widely read U.S. business journal reported that Frederick W. Taylor was micromanaging a gift of \$10,000,000 to the Stevens Institute of Technology in Hoboken, New Jersey. According to this article, Taylor, though dead for eight decades, provided in his will for how this endowment was to be invested and how funds could be spent. In this way, Taylor was allegedly exerting control over his money long after his death. The article was entirely false -- except for the correct spelling of Taylor's name -- and also provided the correct \$10,000,000 figure. Taylor's will (he died in 1915) and the will of his widow, Louise Taylor (who died in 1949), mentioned no gift to Stevens. The idea that Taylor was managing from his grave would catch the attention of a contemporary reader, but in actuality, was totally inaccurate. The reality was that the Stevens Institute of Technology had received a gift of \$10,000,000 from Robert P.A. Taylor in memory of Frederick W. Taylor. Fred and Louise Taylor adopted three children who were orphaned by a tragedy that simultaneously took the lives of their parents, relatives of Mrs. Taylor. Robert Taylor became an extremely successful investment broker and, upon his death, made this gift to his Father's alma mater; the specific instructions on managing the money came from Robert, the investment counselor, not from Frederick W. Taylor (*Business Week*, May 15, 1995, p. 34).

Surveys of scholars in the Academy of Management, the Business History Conference, and the Management History Division of the Academy of Management over three decades have consistently ranked Frederick Taylor as the most influential person in management and business history (Heames & Breland, 2010; Wren & Hay, 1977). Another survey of management scholars named Taylor's *Principles of Scientific Management* as the most influential book of the 20th century (Bedeian & Wren, 2001). This continuing reference to the importance of Taylor and his ideas merits a further examination of his life, ideas, and influence.

Taylor's ideas have not survived unchanged, but his work has inspired study in other disciplines and has been refined by the addition of new information generated in the hundred years since the publication of *The Principles of Scientific Management*. The history of management thought has evolved, presenting the opportunity for us to have a diverse set of tools and techniques for being better managers. But Taylor provided beginning points that have enabled us to extend our thinking. It is important to see him as furthering the search for improving management that began with a set of ideas beginning to form in the latter part of the 19th century. Joseph Litterer called the formation of these ideas "systematic management" and the need to find improved work methods, scheduling of work, more effective incentives, and the ability to produce more efficiently (Litterer, 1961). These ideas were loosely connected, lacking a focal point and someone to pull these ideas together and provide a voice for managing more efficiently.

Early Life and Career

Biographical information about Taylor is readily available (Copley, 1923; Kanigel, 1997; Wrege & Greenwood, 1991; Wren & Bedeian, 2009, 121-155) so a summary should be sufficient in this discussion of him. Frederick Taylor lived in relative luxury from his birth, March 20, 1856, until his death on March 21, 1915. His father, Franklin Taylor, was a lawyer who practiced briefly but had inherited wealth. Taylor Sr. added to that with ownership of a large number of farms and properties in and around Philadelphia, Pennsylvania. Frederick's mother, born Emily Winslow, was of the Delano family, as was Franklin Delano Roosevelt, who later became President of the United States. Emily was a vocal proponent of women's rights and a vigorous opponent of slavery. Later we will suggest the influence Taylor's mother's had on his formation of work groups at Midvale Steel.

He was expected to go to Harvard to become a lawyer, passed the entrance exams with honors, but shortly thereafter, began to have headaches and eye problems. There was concern that studies at Harvard might further injure his health, so he by-passed legal studies to go to work as an apprentice pattern maker at Enterprise Hydraulic Works, then as a worker at Midvale Steel where he would rise rapidly to become chief engineer for the firm of William Sellers. Sellers encouraged Taylor to experiment with the techniques of shop management and for twelve years he would study machine belting, steel tools for cutting metals, and how the workers would give less than they could, a behavior Taylor called "soldiering." He was not the first person to find this restriction of output, but his curiosity was aroused when it came to how he might improve working conditions so the workers would improve their performance. This was the beginning of his use of time study to set performance standards and the idea of a differential piece-rate incentive plan that paid ordinary wages for making the output standard and higher wages for performance above the minimum.

He felt it was management's responsibility to find the proper tools, plan the assignment of work, and provide instructions that would enable workers to earn the performance bonus. Taylor was an engineer, receiving his bachelor's degree in Mechanical Engineering at the Stevens Institute of Technology in 1883, but he felt there was a need for scientific study "of the motives that influence men" (Taylor, 1911, p. 119). His training did not enable him to be a behavioral scientist to study motivation, but he felt that monetary incentives, given after a task had been properly determined and studied, would overcome soldiering.

At Midvale Steel, the workers formed groups according to their ethnic background: Polish workers preferred to work with others from Poland, Germans with other Germans, and so on. Taylor felt these cliques were not appropriate for everyone working together, so he broke up the ethnic work groups "by hiring African-Americans and distributing them among existing work teams" (Dawson, 2004, p. 236). This practice was the first to overcome the racial bias in Philadelphia machine shops and perhaps was influenced by Taylor's mother's stance for integrating African-Americans into work places and society.

The Engineer as an Economist

In 1880 the American Society of Mechanical Engineers (ASME) was founded. Taylor joined in 1886. He was in attendance when Henry R. Towne, President of the Yale and Towne Manufacturing Company, presented a paper on “The Engineer as an Economist.” Towne (1886, pp. 428-429) observed that:

“there are many good mechanical engineers: there are also many good ‘businessmen’; but the two are rarely combined in one person. But, this combination of qualities ... is essential to the management of industrial works, and has its highest effectiveness if united in one person... the matter of shop management is of equal importance with that of engineering... and the *management of works* has become a matter of such great and far-reaching importance as perhaps to justify its classification also as one of the modern arts . . . [and] essential to the efficient management of the business, and especially to increased economy of production”.

Since no other engineering group appeared to be concerned with management, Towne proposed that the ASME create an “Economic Section” to act as a forum for “shop management” and “shop accounting.”

Shop management would deal with the subjects of organization, responsibility, reports, and all that pertained to the “executive management” of works, mills, and factories. “Shop accounting” would treat the question of time and wage systems, determination and allocation of costs, methods of bookkeeping, and all matters that pertained to manufacturing accounts. Thus, a body of literature could be developed, existing experience could be recorded, and the ASME could provide for an interchange of ideas about management. Towne’s paper was a significant turning point in the development of management thinking because of his recognition that factories needed engineers who would think in economic terms of efficiency.

Towne’s paper encouraged Taylor to think beyond technical and engineering problems and to turn his attention to shop management. Taylor drew upon his experiences at Midvale Steel and presented a paper to his fellow engineers on “rate-fixing” (i.e. setting standards) and piece rate incentives. His position was that once the time to perform a task was known and the amount of output that could be produced in a day was determined, the issue became getting the worker to produce at that level and not restrict output. Taylor was chagrined to find that in the following discussion his colleagues focused on incentives and not on setting the rate — Taylor felt that incentives were meaningless unless the standard had been determined (Taylor, 1895).

Taylor’s interest in the economical use of resources led to his first book, *Shop Management* (Taylor, 1903). Originally a paper presented to ASME members, *Shop Management* contained many ideas that he would refer to in his papers, books, and presentations: time study to eliminate wasted motions and to set an appropriate standard of performance (“rate-fixing”); pay for performance through a “differential piece rate” which he adopted from Midvale’s prior practice; functional foremen; management by exception; worker selection and training; mutual accident insurance, with the cost shared by the employer and the worker, restriction of output by workers

(“soldiering”); and the mutual interests between workers, who wanted high wages, and the manufacturers, who wanted low costs, both being attainable through Taylor’s task management. *Shop Management* was a handbook for managers, not an academic presentation, and placed the responsibility on management to do a better job of setting standards, selecting and training, providing incentives, and recognizing the shared interests they had with their employees.

Increasing Recognition for Taylor

Taylor’s reputation among engineers in the United States, Europe, Great Britain, and Japan was well established from his publications and experiments on belting, shoveling, high speed steel-cutting tools at Midvale Steel and loading ‘pig-iron’ later as a consultant at Bethlehem Steel. He attracted a number of followers such as Henry L. Gantt, Horace King Hathaway, Morris Cooke, Sanford Thompson, and Carl Barth to whom he would typically give consulting assignments and he became more of a ‘consultant’s- consultant.’ Daniel Nelson traced the work of his disciples and found “general adherence to Taylor’s ideas” and a “strong positive correlation” between the installation of his ideas and improved efficiency (Nelson, 1974, p. 500). Harvard Professor C. Bertrand Thompson also studied 113 applications of Taylor’s ideas: of those, 59 were complete successes; 20 were partially successful; and 34 were failures which Thompson attributed “to the personality of the consulting engineers . . . and the personality of the managements” (Thompson, 1917, p. 13). None of the failures were due to workers’ shortcomings.

Taylor became President of the ASME in 1906 and was coaxed into lecturing on his ideas at Harvard University’s Graduate School of Business Administration by its first dean, Edwin Gay. His lectures were given each winter semester from 1909 to 1914. For a brief period, Bertrand Thompson arranged Taylor’s presentations and would later set up his own consulting firm following Taylor’s ideas with some modifications to allow for the engrained power of trade unions, in France and other parts of Europe.

It was not all work and no play for Taylor: he landscaped the family home at Boxly near Philadelphia, experimented with soil mixtures to improve golf greens, designed golf clubs, including a “Y” shaped putter, and teamed with his brother-in-law, Clarence M. Clark, to win the U.S. Lawn Tennis Association’s amateur lawn tennis championship in 1881 (Taylor & Bedeian, 2007).

How Management Became “Scientific”

Taylor’s reputation among industrial engineers was growing and the successful consulting assignments by him and his colleagues would bring an unusual twist in the course of management history. In 1910, a collection of railroads operating north of the Potomac and Ohio rivers and east of the Mississippi river petitioned the Interstate Commerce Commission for a rate increase on freight shipped. Their appeal to the commission became known as the Eastern Rate Case and it would have long-range implications for Taylor’s ideas. The shippers hired Louis D. Brandeis, known as the “people’s lawyer” for accepting controversial cases, to represent them. Brandeis searched for information to present his case and met with Frank Gilbreth, Henry V.R. Scheel of Brighton Mills, Henry L. Gantt, and Robert T. Kent, editor of the *Industrial*

Engineering Magazine to discuss the shippers' case. At this time, Taylor's work was referred to as "task management," the "Taylor System," or "modern methods of management," but no one label was universally used. Brandeis noted Taylor often used "scientific" in his writing and those in attendance agreed this would be a good description of what Taylor sought.

In the Interstate Commerce Commission hearings, Brandeis argued that the railroads were only seeking profits, had disregarded operations costs, and would be more efficient if they used "scientific management." He called as witnesses individuals who had installed Taylor's system in their workplaces; James M. Dodge provided testimony about the successes at the Link-Belt Company; H. K. Hathaway gave evidence of the improvements at Tabor Manufacturing. However, it was Harrington Emerson who gave the most sensational testimony. Emerson had been a consultant on the Atchison, Topeka, and Santa Fe Railroad, and had compared their costs with those of other railroads. He concluded it was possible for the railroads to save \$300 million a year, with \$240 million coming from labor costs (*Evidence Taken by the Interstate Commerce Commission*, 1911).

Emerson's testimony made newspaper headlines as "one million dollars a day" and "scientific management" became the phrase for management to cut costs and yield savings to consumers. A railroad historian, Albro Martin, wrote the basis of Emerson's testimony was his claim that railroad workers were typically five percent inefficient and, if \$240 million came from savings on labor, one-third of all railway workers would be eliminated (Martin, 1971, pp. 213-219). The ICC denied the railroads' request for a rate increase and Louis Brandeis added to a reputation that would lead him to become an Associate Justice of the U.S. Supreme Court. When Taylor, was asked about Emerson's testimony, he replied: "I believe we can save a million dollars a day, just as he said we can, but the reports of these hearings in Washington were not quite fair enough to say that it can't be done all at once. It would take four or five years" (Taylor, 1911, pp. 256-257).

Taylor preferred the phrase "task management," fearing "scientific management" sounded too academic. After 1911 and the Eastern Rate case, what might have been "Principles of Task Management" would take on a new identity. It is speculative of course, but Taylor might have endured less criticism if Brandeis had not coined "scientific management" and painted a bulls-eye on Taylor's work.

Emerson's testimony led to publicity for the new label, scientific management, and aroused the ire of the railway brotherhoods, which had a great deal to lose if the railroads eliminated numerous jobs of porters, engineers, brakemen, and others who were on the trains themselves. In shops where trains were repaired or refitted, the International Association of Machinists represented those workers and they too would have been affected by the recommended layoffs.

Before the Eastern Rate Case, General William Crozier, Head of U.S. Ordnance, was in contact with Taylor about the sloppy management of the military arsenals. The arsenals at Watertown, New York, and Rock Island, Illinois, were chosen for initial study. In 1908, Colonel Frank Hobbs, eager to undertake the plan to improve performance at the Rock Island Arsenal, independently assigned the task of time study to his officers, although none of them were trained in this work and the machinists

were not told why they were being timed. The workers protested to their congressional representatives and General Crozier immediately ordered Hobbs to cease timing the workers (Nelson, 1980).

At the Watertown Arsenal, Taylor advised Crozier to proceed cautiously and sent Carl Barth to prepare the workers, including seeking their ideas about being timed on the job. Dwight Merrick, sent to assist Barth, began time study regardless of Taylor's instructions. The first worker Merrick attempted to time refused to continue his work and was discharged by Colonel Charles Wheeler, the commanding officer. The remaining workers went on strike August 1911; this was the first strike under Taylor's task management (Copley, 1923, p. 344). The machinists union petitioned Congress to investigate the mistreatment of Watertown's workers.

The Congressional Investigation began in October 1911 and lasted until February 1912 (*Hearings before the Special Committee of the House of Representatives*, 1912). After months of hearings and the testimony of numerous witnesses, the investigating committee found no fault with Taylor's system or any others; no evidence was offered of abuse to workers and there was no need for remedial legislation (Wren & Bedeian, 2009). The investigation occurred, however, as *The Principles of Scientific Management* was in the process of being published.

The Principles of Scientific Management

In 1907, Taylor began to invite those who were interested in his ideas to come to his home, "Boxly," in Chestnut Hill, a suburb of Philadelphia, where he would lecture on his system. These lectures were well attended and Morris L. Cooke, a disciple of Taylor, employed a stenographer to record Taylor's talks which Cooke would edit. Cooke's intent was to publish a polished version of Taylor's Boxly talks as a book, originally entitled *Industrial Management* (Wrege, 2008). After studying the lecture, Cooke advised Taylor that he should change the tone of his talks to make them sound less dictatorial, and to reduce the amount of time spent talking about slide rules (15 minutes) and pig-iron handling and shoveling (1.5 hours) (Taylor, 2008).

By 1908, the ASME began to forget Henry Towne's plea about the engineer as an economist and began to define their mission in a more narrow fashion. For example, the ASME declined to join the Conservation League of America, the League of Good Roads, and rejected Morris Cooke's proposal that engineers should be concerned with smoke abatement in industry (Calvert, 1967).

Taylor was President of the ASME in 1906 but an increasing number of the members did not like the direction he was taking regarding efficiency, management, and the conservation of resources. After the Eastern Rate Case and the Brandeis-coined phrase, scientific management, ASME members who were affiliated with the railroads objected, especially to Harrington Emerson's claim of \$1,000,000 a day savings if the railroads adopted scientific management. Taylor wanted the ASME to recognize his "scientific management" as based on scientific laws (Layton, 1971, pp. 140-141).

By 1910, Taylor was ready to publish *The Principles of Scientific Management* though it has been alleged that Taylor plagiarized 69 pages of Cooke's *Industrial Management* to use in his work. Plagiarism is a serious charge therefore, some explanation is needed. Taylor offered to give the royalties to Cooke if *Principles* interfered with the

sales of *Industrial Management* but Cooke declined. In the manuscript for *Industrial Management*, in Cooke's handwriting, he wrote that Chapter 2 (the one allegedly plagiarized) "is very largely a recital of Mr. Taylor's personal experiences in the development of scientific management, and as such has been written by himself in the first person" (Wrege & Stotka, 1978, pp. 746-747). Cooke edited and polished Taylor's Boxly talks which provided a portion of what became *The Principles of Scientific Management*.

The archives of Harper & Brothers, publishers of *The Principles of Scientific Management*, indicate that Taylor assigned over \$3,200 in royalties to Cooke from June 1911 (the month *PSM* was published until the last quarter of 1913) (Archives of Harper & Brothers, 1982). It seems reasonable to conclude that Cooke, and possibly others, contributed to, but did not actually write *PSM*. Cooke took Taylor's Boxly talks, edited and enriched them and received the royalties for his work. The fact that *PSM* took many different published appearances suggests further evidence that the ideas were Taylor's.

Appearances before Final Publication of The Principles of Scientific Management

Taylor submitted his paper to the ASME for publication but, after a year-long delay, it was rejected by the publications committee. Taylor's determinations to have his work reach a wider audience and to overcome the ASME's rejection led to numerous appearances. First, Taylor distributed a private printing of *PSM* in February 1911 "for confidential circulation among the members of the American Society of Mechanical Engineers with the compliments of the author" (Taylor, 1911, p. 118).

This was followed in March, April, and May 1911 when the *American Magazine* published Taylor's book as *The Gospel of Efficiency*, with various subtitles. It included pictures of Taylor, Taylor's mother (Emily Winslow Taylor), the Taylor home at Chestnut Hill, Gantt, Dean Gay of Harvard University, Barth, Emerson, Cooke, and numerous others associated with Taylor's work. One unusual set of photographs appeared of Frank Gilbreth's bricklayers in before and after positions in applying scientific management. The *American Magazine* had a following in the general public and Taylor intended to spread the gospel as far as possible.

The *Journal of Accountancy* published *The Principles of Scientific Management* in a two-part series, May and July of 1911, based on an unedited, extemporaneous address before the Civic Forum in New York on April 28, 1911. This abbreviated version presented many of Taylor's ideas, but omitted any reference to Taylor's familiar example of 'pig-iron' handling and shoveling. Taylor had been tutored in accounting and one component of his management system aimed at reducing production costs. He also had a large following of accountants who were interested in scientific management. Others, such as Louis Brandeis, Alexander Hamilton Church, Frank Gilbreth, and Henry L. Gantt also published articles in the *Journal of Accountancy* about industrial efficiency and scientific management.

The Civic Forum presentation in New York city was another opportunity for Taylor to carry his message of better management to the public and those in corporate executive positions. This speech focused on the problems of restricted output and the influence of unions; the new responsibilities of management and how these new

scientific management duties would increase output (Taylor, 1911, pp. 117-124; Taylor, 1911, pp. 181-188). Carol Dean concluded these presentations of *The Principles of Scientific Management* were altered slightly because of the target audience and limits on time or journal space, but the message remained the same.

Another tailored version was presented at the Dartmouth College as part of a book titled *Scientific Management: Dartmouth College Conferences*. This version presented many of Taylor's earlier anecdotes, but added the work of a surgeon and how an apprentice would be trained (Taylor, 1912, p. 54). Frank Gilbreth did numerous studies of surgical procedures and Taylor had frequently used surgery as one of his teaching examples. At this time, Taylor and Gilbreth had not had their serious disagreement over work that Gilbreth was doing for a firm in Germany.

Conclusion

Within two years of its 1911 publication, *PSM* was translated into French, German, Dutch, Swedish, Russian, Italian, and Japanese. Taylor's early work, *Shop Management*, appealed to engineers, but *PSM* appealed to a broader audience in the U.S., Europe, and Japan. The message was global, calling for the improved utilization and conservation of human and physical resources. It is important to see Taylor in the context of his era, an era of needed reform and progressive management in industry, arsenals, naval ship yards, government, and education. One measure of Taylor's impact as an example of this need was in collegiate education. Nelson identified 21 colleges and universities that offered a course in scientific management in colleges of business or engineering by 1920 (Nelson, 1992, p. 83).

Taylor's ideas traveled to Europe, but with varied success. In England, scientific management was not held in high esteem (Whitson, 1997, pp. 207-209). In France, Henry Le Chatelier and Charles de Freminville translated and promoted Taylor's writings and became leading individuals in the acceptance of scientific management; but in Germany, the Germans adopted their own brand of work study that approximated Taylor's work (Devinat, 1927; Thompson, 1940). Japan was emerging from its agrarian history into the industrial age and scientific management found fertile soil for its study and application (Taira, 1970). Yukinori Hoshino translated *PSM* into Japanese in 1912 and Yoichi Ueno carried those ideas forward (Greenwood, Greenwood & Ross, 1981).

In the U.S.S.R., Lenin approved of more work, but not always what Taylor had envisioned as a product of work study and improvement. "Stakhanovites" became heroes and won medals because they were the high producers (Bedeian & Phillips, 1990) and production goals were set by the Communist leaders regardless of worker capabilities (Wren & Bedeian, 2004). Henry L. Gantt's method of charting formed the basis for Soviet five-year plans through one of Gantt's followers, Walter N. Polakov (Wren, 1980).

One hundred years later *Principles of Scientific Management* remains a lasting contribution to the development of management thought. Taylor continues to dominate any list of persons who have made business management a worthy calling and a fitting topic to study. His reach was international and to a broad spectrum of audiences and his ideas shaped how we live and think today.

References

- Archives of Harper & Brothers (1817-1914). Reels 31 and 32 of microfilm published by permission of Harper & Row and the Butler Library of Columbia University Library. Index compiled by Christopher Feeney, Cambridge University Press, 1982, 590, 762 of the ledger provided courtesy of Carol Carlson (Dean) Gunn.
- Bedeian, A.G. & Wren, D.A. (2001). Most influential books of the Twentieth Century, *Organizational Dynamics*, 29 (3): 63-84.
- Bedeian, A.G. & Phillips, C.R. (1990). Scientific Management and Stakhanovism in the Soviet Union: A Historical Perspective, *International Journal of Social Economics*, 17: 28-35.
- Calvert, M.A. (1967). *The Mechanical Engineer in America, 1830-1910: Professional Cultures in Conflict*, Baltimore: Johns Hopkins University Press.
- Copley, F.B. (1923). *Frederick W. Taylor: The Father of Scientific Management*, New York: Harper & Brothers.
- Dawson, A. (2004). *Lives of Philadelphia Engineers: Capital, Class, and Revolution, 1830-1890*, Aldershot, England: Ashgate Publishers.
- Dean, C.C. (1997). The Principles of Scientific Management by Fred Taylor: Exposures in print beyond the private printing, *Journal of Management History*, 3: 4-17.
- Devinat, P. (1927). *Scientific Management in Europe*, Geneva: International Labor Office
- Greenwood, R.G., Greenwood, R.A. & Ross (1981). Yoichi Ueno: A Brief History of Japanese Management, 1911 to World War II, in K.H. Chung (ed.), *Proceedings of the Annual Academy of Management Meetings*: 107-110.
- Heames, J.T. & Breland, J.W. (2010). Managements pioneer contributors: 30-Year review, *Journal of Management History*, 16 (4): 427-436.
- Hearings before the Special Committee of the House of Representatives to Investigate the Taylor and Other Systems of Shop Management (1912)*, under authority of House Resolution 90, Washington, D.C.: U.S. Government Printing Office.
- Kanigel, R. (1997). *The One Best Way: Frederick W. Taylor and the Enigma of Efficiency*, New York: Viking.
- Layton, Edwin T. Jr. (1971). *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession*, Cleveland: Case Western Reserve University Press.
- Litterer, J.A. (1961). Systematic management: The search for order and integration, *Business History Review*, 35: 461-476.
- Martin, A. (1971). *Enterprise Denied: Origins of the Decline of American Railroads, 1897-1917*, New York: Columbia University Press.
- Micromanaging from the Grave (May 15, 1995), *Business Week*: 34.
- Nelson, D. (1974). Scientific management, systematic management, and labor, 1880-1915, *Business History Review*, 48: 479-500.
- Nelson, D. (1980). *Frederick W. Taylor and the Rise of Scientific Management*, Madison, WI: University of Wisconsin Press.
- Nelson, D. (1992). Scientific management and the transformation of university business education. In Nelson, D. (Ed.), *A Mental Revolution: Scientific Management since Taylor*, Columbus, OH: Ohio State University Press, 1992: 77-101.
- Taira, K. (1970). Factory legislation and management modernization during Japan's

- industrialization, 1886-1916. *Business History Review*, 44: 84-109.
- Taylor, Frederick W. (1903). *Shop Management*, New York: Harper & Row.
- Taylor, Frederick W. (1911). The gospel of efficiency: the new science of business management, *American Magazine*, 71: 563-581.
- Taylor, Frederick (1911). The Principles of Scientific Management, *American Magazine* 71: 785-793.
- Taylor, Frederick (1911). The Principles of Scientific Management, *American Magazine* 71: 101-113.
- Taylor, Frederick W. (1911). Scientific Management: Principles and Methods, *Journal of Accountancy*, 12: 117-124.
- Taylor, Frederick W. (1911). Scientific Management: Principles and Methods, Part II, *Journal of Accountancy*, 12: 181-188.
- Taylor, Frederick W. (1911). *The Principles of Scientific Management*, New York: Harper and Brothers.
- Taylor, Frederick W. (January 14, 1911). The Conservation of Human Effort, address to the Philadelphia Club, Taylor Collection. Reprinted in T. Sasaki & D.A. Wren (Eds.), *Taylor and His Comrades*, London: Pickering & Chatto, Series 2, Vol. 2: 256-257.
- Taylor, Frederick W. (1912). The Principles of Scientific Management, *Addresses and Discussions at the Conference on Scientific Management held October 12, 13, 14, Nineteen Hundred and Eleven*, Hanover, NH: Amos Tuck School of Administration and Finance, Dartmouth College: 22-55.
- Taylor, Frederick W. (2008). A report of a lecture and questions put to Mr. Taylor: a transcript, *Journal of Management History*, 14: 214-236.
- Taylor, S.G. & Bedeian, A.G. (2007). From boardroom to bunker: how Fred Taylor changed the game of golf forever, *Management & Organizational History*, 2: 195-218.
- Thompson, C.B. (1917). *The Theory and Practice of Scientific Management*, Boston: Houghton Mifflin.
- Thompson, C.B. (1940). The Taylor system in Europe, *Advanced Management*, 5(4): 172-176.
- Towne, H.R. (1886). The Engineer as an Economist, *Transactions*, ASME, 7: 428-432.
- Whitson, K. (1997). The reception of scientific management by British engineers, 1890-1940, *Business History Review*, 71: 207-229.
- Wrege, C.D. & Greenwood, R.G. (1991). *Frederick W. Taylor, the Father of Scientific Management: Myth and Reality*, Homewood, IL: Business One Irwin.
- Wrege, C.D. & Stotka, A.M. (1978). Cooke creates a classic: the story behind F.W. Taylor's Principles of Scientific Management, *Academy of Management Review*, 3: 736-749.
- Wrege, C.D. (2008). F.W. Taylor's Lectures on Management, June 4, 1907, *Journal of Management History*, 14: 209-213.
- Wren, D.A. (1980). Scientific management in the U.S.S.R., with particular reference to the work of Walter N. Polakov, *Academy of Management Review*, 5: 1-11.
- Wren, D.A. & Bedeian, A.G. (2004). The Taylorization of Lenin: Rhetoric or reality? *International Journal of Social Economics*, 31: 287-299.
- Wren, D.A. & Hay, R.D. (1977). Management historians and business historians:

differing perceptions of pioneering contributions, *Academy of Management Journal*, 20: 470-475.

Wren, D.A. & Bedeian, A.G. (2009). *The Evolution of Management Thought 6th ed.* New York: John Wiley & Sons.