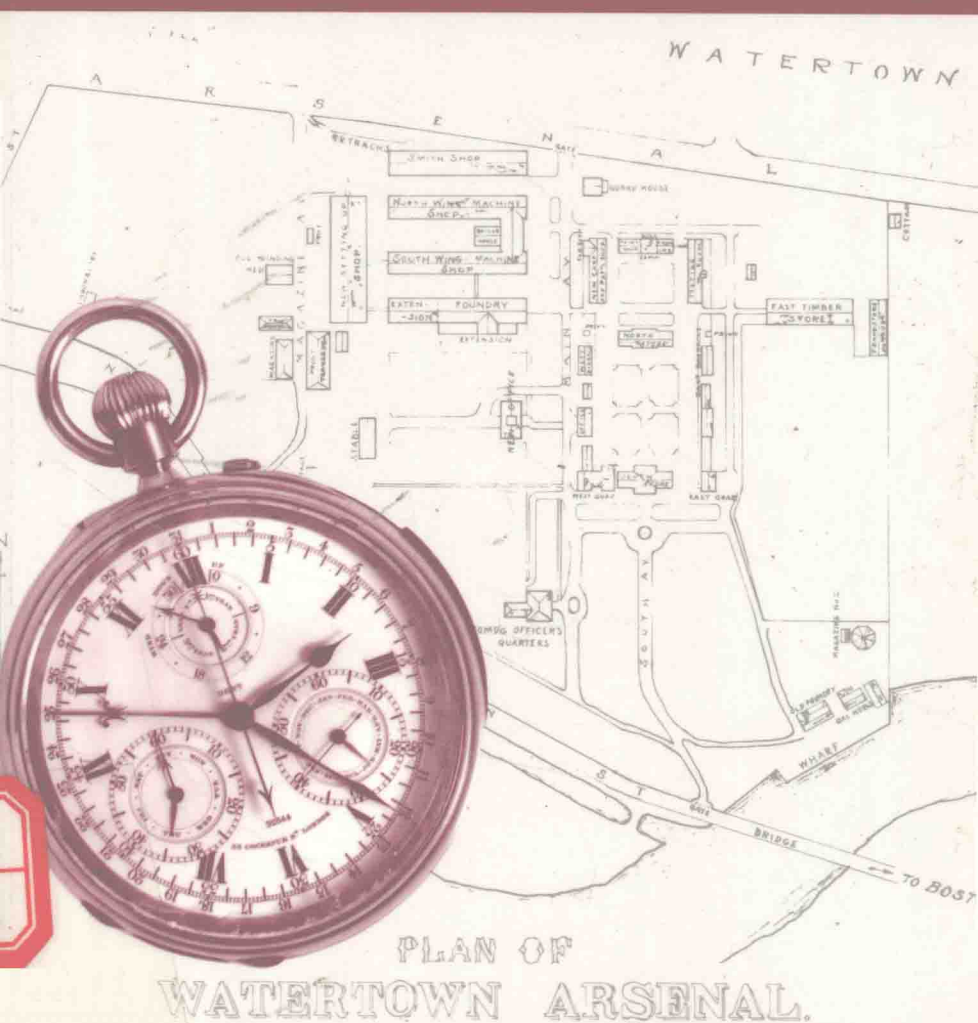


SCIENTIFIC MANAGEMENT IN ACTION

Taylorism at Watertown Arsenal, 1908-1915

HUGH G. J. AITKEN



PLAN OF
WATERTOWN ARSENAL.

With a new foreword by Merritt Roe Smith

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IN
ACTION

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190^{}8-1915*

By

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Merritt Roe Smith

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FOREWORD

The social history of technology has become quite fashionable in recent years, but it is not new. In fact, one of the best works in the field actually predates it by more than a decade. I refer, of course, to Hugh G. J. Aitken's masterful study of *Scientific Management in Action*.

Taylorism, the shorthand expression for Frederick W. Taylor's brand of scientific management, is one of the most frequently discussed topics in American business and technological history. General textbook writers often address the subject, and students of the Progressive Era invariably refer to it as an example of the reformist impulse to rationalize American society. In their efforts to make sense of Taylorism and place it in context, historians have brought a variety of interpretative perspectives to the study of scientific management. Some, like Frank B. Copley, Sudhir Kakar, and Daniel Nelson, approach the subject through the medium of biography and provide absorbing accounts of Taylor and his circle.¹ Others, like Samuel Haber, examine the movement through the prism of politics in order to reveal basic changes in the country's political structure at the turn of the twentieth century.² Still others view Taylorism as a critical juncture in the rise of modern industrial management and, depending on their point of view, depict the movement either as a force for more efficient business administration or as a frontal assault on the traditional prerogatives of labor.³ Yet, as good as they are, none of these writers surpass Hugh Aitken in portraying the complex technical and human relationships that comprised scientific management.

When *Scientific Management in Action* first appeared in

1960 under the title *Taylorism at Watertown Arsenal*, it received an enthusiastic reception from reviewers. In his contribution to *The American Historical Review*, Alfred D. Chandler, Jr. hailed the volume as "the clearest picture yet written on the nature and significance of scientific management." Moreover, everyone who reviewed the book reached much the same conclusion. Writing in the *Business History Review*, George S. Gibb praised the book as "extremely competent" and "a classic in its field." John B. Rae agreed. "This book will be indispensable," he observed in the *Journal of Economic History*; "it can well be used as a model by those who believe that scholarly history can be written with literary charm." In fact, the only negative comment came from Gibb who mildly chided Aitken for being too cautious and restrained "in relating the Watertown episode to broad forces at work elsewhere" in American society. Gibb quickly added, however, that his remark "probably is not a criticism at all."⁴

Twenty-five years have elapsed since the book's publication, yet it remains as fresh today as it was in 1960. A question worth asking is why this is so. What accounts for the book's remarkable longevity and influence?

To my mind, three attributes—clarity, insight, and originality—distinguish the volume and give it special standing in the world of scholarship. There is no need to belabor the subject of clarity. As most readers immediately recognize, Aitken excels at describing the Taylor system and relating its component parts. But more than that, he reveals how various actors in the Watertown story—ordnance officers, arsenal workers, and Taylor associates—perceived the changes that were taking place and how they responded to them. The installation of Taylor's system at Watertown turns out to be a complicated saga fraught with misunderstanding, distrust, and conflict. Aitken succeeds in unraveling these complex social relations because he obviously understands the subject and writes with authority and feeling. By couching his study

within a well-defined community setting, he also is able to move back and forth between the general and specific aspects of the subject and to use one aspect as a means of illuminating the other. Each chapter thus provides a different angle of vision on scientific management. With each view comes an enhanced understanding of the system's complexity and importance.

Aitken's account is filled with revealing insights into the nature of scientific management. We learn, for example, that the primary goal of Taylorism was not merely to get employees to work harder but to control the entire job situation. We also learn that standardization became the primary means of achieving control. From the planned scheduling and routing of work in progress to the use of uniform belting and high-speed steel cutting tools, all of the innovations that together comprised scientific management were designed, as Aitken puts it, "to achieve total control of the job and its performance and in particular to enable management to prescribe and enforce a standard work pace" (pp. 28-29). Taylor's insistence that "no time studies should be attempted until all working conditions had been brought up to a high level of efficiency" reveals how vital uniform standards were to his system of management. Until Aitken clarified the nexus between standardization and control, few people fully appreciated this important aspect of scientific management.

An underlying premise of Taylorism, one that produced serious discord at Watertown, held that knowledge of every aspect of production was necessary for managerial control. "If Taylor was to attain his primary goal of securing complete control over the pace of work," Aitken writes, "it was essential that he know precisely the maximum rate of output of which his machines were capable" (p. 31). This meant that managers or their surrogates, the efficiency experts, had to enter the shop, observe workers at close range, and scrupulously record what they saw in an effort to acquire an under-

standing of individual production tasks. Doing so, of course, was touchy business, particularly when the observer entered the shop unannounced with a stop watch in his hand. In delineating the sources of conflict at Watertown, Aitken reveals, as no one had before, that knowledge was power and that workers sensed the threat time studies posed to their autonomy. Such studies were intolerable because they aimed at transferring the skills of the worker to the engineer. Faced with the loss of the one thing that insured their power on the shop floor, the molders at Watertown expressed themselves eloquently about their fear of dispossession. Aitken quotes one molder's statement that "I don't like a man to stand over me with a stop watch because it looks to me as if it is getting down to slavery." Others "felt hustled and driven and resented the idea of being set in competition with each other." It was "humiliating" and "un-American" (pp. 216, 150). When the molders walked out of the shop on August 11, 1911, Taylor knew that "a fundamental issue was at stake." "This strike hits at the very foundation of scientific management," he wrote to his colleague Carl Barth, "and if the owners of the company or the government are not to be allowed to obtain exact information, then scientific management becomes impossible" (p. 164). Taylor realized that technical knowledge was the basis of power and that "no limits could be placed on management's right to know" (p. 165). Thanks to Aitken's penetrating analysis, we now appreciate the full significance time studies had for labor-management relations under the Taylor system.

Other important insights enhance the book's reputation as a scholarly work. Aitken recognizes, for instance, that technology and management are inseparable and that one cannot study one without studying the other. Perhaps the most surprising insight is his discovery that time studies involved arbitrary, rule-of-thumb decisions that were not scientific at all. "The apparent accuracy and objectivity of stop-watch

time study," he concludes, "was therefore to a large extent an illusion . . . a ritual whose function it was to validate, by reference to the apparent objective authority of the clock, a subjective estimate of the time a job should take" (p. 26).

The subjectivity of this aspect of Taylorism becomes an important consideration in understanding the molders' reaction to being timed at their work. Indeed, Aitken points out that their distrust of the Taylor system stemmed largely from the fact that Dwight Merrick, the time-study expert at Watertown, knew little about foundry work and made arbitrary decisions about the length of time it should take for a molder to execute his work. This, coupled with the fact that Taylor and his military employers remained oblivious to the feelings and traditions of the Watertown work force, paved the way for confrontation. Not even the prospect of higher wages under Taylor's famous premium system could persuade the molders to acquiesce to the new regimen. If anything, it increased their suspicion "that they were being bribed or fooled into doing something that was not in their interest" (p. 211). Ultimately Taylorism failed at Watertown Arsenal because managers neglected to take into account the customs and feelings of those whom they sought to reform. Taylor and his disciples had mastered a number of important technical problems, but they remained blind to the inner workings of Watertown's social system.

What gives the book its special slant—its originality, if you will—is Aitken's attention to the arsenal's social and institutional processes. The topic of Taylorism was not new in 1960, but the way Aitken attacked the subject was. At that time books written about technological innovation tended to focus either on the internal development of new technologies or on their social impact. While Aitken does not ignore these aspects of the subject, the main thrust of his analysis aims at understanding the social tensions that arise when new technologies (including management techniques) are introduced

into the workplace. As indicated at the outset, this mode of interpretation would become well known during the 1970s as the "social history of technology."⁵ Moreover, his effort to explain the unanticipated consequences of scientific management at Watertown provides an early example of retrospective technology assessment, an area of historical inquiry that is still maturing.⁶ Clearly *Scientific Management in Action* is an innovative study, rich in wisdom as well as knowledge. Its evenhandedness in juxtaposing the positions of management and labor make it an exemplary scholarly work. After a quarter of a century it still remains the best study of the day to day aspects of scientific management in action. Princeton University Press is to be congratulated for making this landmark study available again.

Merritt Roe Smith

Massachusetts Institute of Technology

NOTES

1. Frank B. Copley, *Frederick Winslow Taylor* (2 vols., New York, 1923); Sudhir Kakar, *Frederick Taylor: A Study in Personality and Innovation* (Cambridge, Mass., 1970); Daniel Nelson, *Frederick W. Taylor and the Rise of Scientific Management* (Madison, Wis., 1980).

2. Samuel Haber, *Efficiency and Uplift: Scientific Management in the Progressive Era, 1890-1920* (Chicago, 1964). Also see Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Cambridge, Mass., 1959).

3. See, for example, Milton J. Nadwornny, *Scientific Management and the Unions, 1900-1932* (Cambridge, Mass., 1955); David F. Noble, *American by Design: Science, Technology and the Rise of Corporate Capitalism* (New York, 1977), pp. 257-77; Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, Mass., 1977), Chap. 8, esp. pp. 272-81; Daniel Nelson, *Managers and Workers: Origins of the New Factory System in the United States 1880-1920* (Madison, Wis., 1975), pp. 55-78.

4. See Chandler's review in *The American Historical Review* 60 (1960): 240-41; Gibb's review in *Business History Review* 34 (1960): 273-75; and Rae's review in *Journal of Economic History* 20 (1960): 456-57. Other pertinent reviews appear in *Technology and Culture* 2 (1961): 191-93; *The*

Library Journal 84 (Jan. 15, 1960): 270; and Eugene S. Ferguson, *Bibliography of the History of Technology* (Cambridge, Mass., 1968).

5. See, for example, George H. Daniels et al., "Symposium: The Historiography of American Technology," *Technology and Culture* 11 (1970): 1-35; and Anthony F. C. Wallace, *The Social Context of Innovation* (Princeton, 1982), pp. 3-4.

6. For overviews of retrospective technology assessment, see Howard Segal, "Assessing Retrospective Technology Assessment," *Technology in Society* 4 (1982): 231-46; and Stephen Cutcliffe, "Retrospective Technology Assessment," *STS Newsletter* (Lehigh University), 18 (June 1980): 7-12.

AUTHOR'S PREFACE

A generous endowment of natural resources, a culture that placed a high value on material success and individual initiative, a system of government that left economic power decentralized, a high rate of population growth and capital accumulation, and the ability to borrow and adapt techniques from more advanced countries — these are some of the factors conventionally regarded as having contributed significantly to the economic development of the United States and to the standard of living that we currently enjoy. Typically absent from such listings is any reference to business management. If mentioned at all, it is in connection with the deeds of conspicuous and often notorious businessmen — the robber barons, like Rockefeller, Morgan, or Harriman, or the captains of industry, like Carnegie and Ford. This is like writing the history of warfare in terms of generals and battles. Left out of consideration is the unspectacular work of organization, the day-to-day management of men, machines, and materials. It is strange that in the United States of all places the history of business management and the appraisal of its contribution to economic development should have been paid such scant respect.

The research for this book began while I was a member of the Research Center in Entrepreneurial History at Harvard University. Those of us fortunate enough to work in that group shared a common professional interest in the history of business as a social institution. We respected the work of the business historians, and we did not underestimate the value of the evidence that could be accumulated by the preparation of the histories of individual firms. But we

thought that there might be other approaches to the problem. The history of management is the history of ideas, of techniques, of innovations, and of traditions. Development in management is a social process that can be studied in the same way as development in art, in literature, or in science. How have concepts and objectives in business management changed over time? What have been the critical innovations, and how were they accomplished?

To some of my colleagues and to me it appeared that a promising line of attack would be to select a major innovation in business practice, to analyze its content, and to examine its impact upon the ways of doing business that were traditional and normal at the time of its introduction. The Taylor system of management seemed, by these criteria, to be a suitable subject. Here was an innovation that appeared to be clearly identifiable; it could be dated with adequate accuracy; and, to judge by the controversy it aroused, it marked a radical departure from what had gone before.

This book is a study of the Taylor system of management. I have tried to avoid duplicating work that has already been done on the subject. A formal biography of Frederick Taylor is readily available; I have, therefore, felt free to pass lightly over his life and personal activities. Two excellent studies of the reaction of organized labor to the Taylor system have recently been published by Professors Jean T. McKelvey and Milton Nadworny; this topic, accordingly, is dealt with only in outline, to the extent necessary for adequacy of explanation. Nor does this book contain a satisfactory account of the Taylor movement, although that too is a subject of the first importance, essential for an understanding of the origin of the profession of management consultant. What the book does contain is an analysis of the installation of the Taylor system in a particular manufacturing plant, and of the reactions to that installation.

The case method has certain advantages in historical

study: it makes possible an analysis-in-depth that is impossible in a general survey. Regarding Taylorism in particular, case studies are essential for an understanding of the relationship between theory and practice; it is dangerous to base an interpretation solely upon what the Taylor group and their opponents said or wrote about the system. But there are offsetting disadvantages to the case method: one is never quite sure what general significance is to be attached to the particular characteristics of the case chosen. The situation would be much improved if there existed a number of case studies of Taylorism in practice, to make possible systematic comparison. Unfortunately, parallel studies of this type do not yet exist. A few descriptions of plants organized along Taylorist lines are available, thanks to the early work of Hoxie, Babcock, Day, and others; but to the best of my knowledge this is the first empirical account of the introduction of Taylorism — of the process of change as well as the results.

The choice of Watertown Arsenal, a government-owned establishment, may give rise to criticism. The reason for the choice was simply that the source material was immensely richer than for any private firm. From some points of view a private establishment, such as the Bethlehem Iron Company, where Taylor also worked, might have been preferable. The evidence bearing on the Bethlehem case, however, is inadequate for the type of analysis attempted here. At the level of shop management and organization, which is what primarily concerns us here, it may well be doubted whether the fact of government ownership made much difference at Watertown. The institutional reaction to the innovation was admittedly different, because the workers at Watertown had means of protecting their interests not available to workers in private plants. The process of managerial reform, however, and the personal reactions of those involved may not have varied significantly. A workshop in a manufacturing

plant has its own structure and problems, no matter where the formal ownership lies.

There remains only the pleasant obligation of expressing my gratitude to those who have aided me in my work. To my former colleagues at the Research Center in Entrepreneurial History I owe a considerable debt — one of which I have become increasingly aware since leaving that hospitable institution. Professor Leland H. Jenks in particular has given me invaluable help and encouragement. For numerous constructive suggestions I am indebted to the friends and associates who were good enough to read the manuscript before publication, and in particular Professor John T. Dunlop of Harvard University and my colleagues at Riverside, Professor Emeritus Gordon S. Watkins and Professor Charles Woodhouse. The librarian of the Taylor Collection at Stevens Institute of Technology provided invaluable assistance, as did the staff of the Army Section, War Records Division, National Archives. Mr. John P. Frey, president emeritus of the metal trades department, A.F.L.-C.I.O., and Mr. Carl Huhndorff, Director of Research, International Association of Machinists, furnished information otherwise unobtainable which must be acknowledged with gratitude. Lastly, and in a more personal sense, I would acknowledge the unfailing encouragement and assistance of my wife, who not only bore the major responsibility for the physical preparation of the manuscript but also, in less obvious ways, made the completion of the work possible. Responsibility for errors of omission or commission, needless to say, must rest solely with the author.

H.G.J.A.

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