高等学校教材

工业工程专业英语

李宗刚 主编
高 溥 主审

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内容简介

全书共分四篇，分别为：工业工程及其教育、基础工业工程、现代工业工程、工业工程基础学科。本教材通过精心遴选具有代表性的最新高水平英文期刊原文作为素材，为工业工程从业人员提供一本系统介绍工业工程专业概貌和专业词汇的学习材料，教材内容涵盖工业工程专业的大部分学科分支，力图反映本学科的最新进展。

本书可作为工业工程专业本科生的专业英语教材使用，也可作为研究生及工业工程从业人员的参考用书。

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前言

工业工程(Industrial Engineering)是一门起源于美国,以提高企业生产率、产品质量和经济效益为目标的技术与管理有机结合的工程技术学科,在欧美等工业发达国家和地区得到了深入普及和广泛应用。100多年来,工业工程学科经历了科学管理时期(工业工程的缘起)、运筹学时期(工业工程有了理论基础)、定量和精细化时期(计算机的出现,利用信息系统可以帮助决策)、经济全球化和网络化时期(网络化)等四个发展阶段,应用领域扩展到制造业、服务业、医疗、高新技术等众多行业,已经成为全世界企事业单位科学安排生产经营与管理活动、提升绩效的重要工程技术手段。

我国工业工程的教育和应用起步较晚,但发展非常迅速。据不完全统计,目前全国有近200所院校已经设立了工业工程专业。我国企业也完成了对工业工程从陌生到接受的过程,许多企业已经开始主动应用工业工程技术进行生产经营和管理活动的改善。这些客观环境的变化,为我国工业工程学科的深入发展提供了良好的历史机遇。

近年来,我国提出了"以信息化带动工业化,以工业化促进信息化"的跨越式发展战略,以加速我国的工业化进程,应对日益激烈的国际竞争。这一战略的实施大力促进了我国企业的全面发展,使得企业对工业工程高层次人才的需求也日益增多,要求也在不断提升。未来的工业工程从业人员不仅需要掌握工业工程领域广博的专业知识,而且还应该具备同来自世界各地、具有不同教育背景和文化背景的同行进行沟通和交流的能力。英语作为世界上应用最为广泛的语言之一,是工业工程专业人员必须掌握的基本技能。

本教材通过精心遴选具有代表性的最新高水平英文期刊原文作为素材,为工业工程从业人员提供一本系统介绍工业工程专业概貌和专业词汇的学习材料,教材内容涵盖工业工程专业的大部分学科分支,力图反映本学科的最新进展。在教材的编写中,主要贯彻了以下原则:

(1)力求使所选素材与工业工程专业课程起到很好的互补作用。为此,本教

材在介绍专业知识、词汇的同时，也力图扩展学生的视野，加深他们对工业工程主流研究方向及前沿的认识。

(2)选材以欧美工业发达国家学者所撰写的综述性文章为主，将他们对于工业工程学科发展的思考、研究方法、以及对未来的展望等相关信息介绍给我国工业工程从业人员，特别是本科生和研究生。

(3)鉴于工业工程学科的知识体系博大精深，涵盖范围和内容非常广泛，在一本专业英语教材中展现所有的内容是不可能的。编者在参考文献中除了列出本教材所选素材原文之外，还选列了一些与之相关的其他文献，旨在抛砖引玉，希望能够对学有余力且对所列文献研究方向感兴趣的读者有所帮助。

(4)本书罗列了与工业工程学科相关的学术刊物信息，内容选自哈尔滨工业大学于云玲、阎纪红老师所编《工业工程专业英语》一书。另外，在词汇表方面，除汇总每章后面的词汇之外，也收录了其他教材中列出但本书中没有出现的专业词汇，以方便读者查阅。

本书可作为本科生的专业英语教材使用，也可作为研究生及工业工程从业人员的参考用书。编者希望通过本书的学习，工业工程专业学生、老师及从业人员能够理解和掌握工业工程学科的英语表达习惯，具备运用专业英语知识进行阅读、交流及沟通的能力。

本书由兰州交通大学李宗刚主编，高溥主审。具体分工如下：李宗刚编写第1篇，第2篇第3、4、8、9章，附录1；兰州交通大学石慧荣编写第2篇第5、6、7章，第4篇第16、17章；陈引娟编写第3篇及附录2；李晶编写第4篇第18、19章。

本书在编写过程中，得到了兰州交通大学机电工程学院相关领导、专业老师及兰州理工大学赵家黎博士的大力支持和帮助，在此表示衷心感谢。

由于编者水平有限，书中难免存在疏漏和不妥之处，恳请读者批评指正。

编　者

2014年3月

目录

第1篇 工业工程及其教育

1 Brief History of Industrial Engineering 工业工程简史

1.1 Introduction

The growth of industry during the last quarter of the nineteenth century inspired one of the most influential efforts to promote the coordination of economic activity: the industrial engineering movement of the early twentieth century. Although railroads had devised elaborate methods of internal communications and record keeping by mid-century, the late nineteenth century factory remained a loosely organized cluster of operations. Coordination depended on the leadership of plant executives and personal relationships between supervisors. Indeed, the distinguishing feature of factory management was the conspicuous role of the first-line supervisor; foremen organized materials and labor, directed machine operations, recorded costs, hired and fired employees, and presided over a largely autonomous empire. In the 1870s and 1880s, however, critics began to attack the "chaotic" condition of contemporary industry and to propose a more systematic, centralized approach to production management. Their critique became the basis for the best-known effort to encourage coordination within the firm during the first half of the twentieth century. Under various labels-systematic management, scientific management, efficiency engineering, and, by the 1920s, industrial engineering-it fostered greater sensitivity to the manager's role in production and greater diversity in industrial practice, as managers selectively implemented ideas and techniques.

1.2 Systematic and Scientific Management

The attack on traditional management originated in two late nineteenth century developments. The first was the maturation of the engineering profession, whose advocates sought an identity based on formal education and mutually accepted standards of behavior and who rejected empiricism for scientific experimentation and analysis. The second development, closely related, was the rise of systematic management, an effort among engineers and sympathizers to substitute system for the informal methods that had evolved with the factory system. Systematic management was a rebellion against tradition, empiricism, and the assumption that common sense, personal relationships, and craft knowledge were sufficient to run a factory. The revisionists' answer was to replace traditional managers with engineers and to substitute managerial systems for guesswork and ad hoc evaluations.

By the late 1880s, cost accounting systems, methods for planning and scheduling production and organizing materials, and incentive wage plans were staples of a burgeoning literature of industrial management. Their objective was an unimpeded flow of materials and information. In human terms, systematic management sought to transfer power from the first-line supervisor to the plant manager and to force all employees to pay greater attention to the manager's goals. Most threatening to the status quo, it promoted decisions based on performance rather than on personal qualities and associations.

In the 1890s, an ambitious young inventor, manager, and consultant, Frederick Winslow Taylor, became the most vigorous and successful proponent of systematic management. As a consultant, he introduced accounting systems that permitted managers to use operating records to guide their actions, production-control systems that allowed managers to know more precisely what was happening on the shop floor, piece-rate systems that encouraged workers to follow orders and instructions, and various related measures. In 1895, he employed a colleague, Sanford E. Thompson, to help him determine the optimum time to perform industrial tasks; their goal was to compute, by rigorous study of the worker's movements and the timing of those movements with stopwatches, standards for skilled occupations that could be published and sold to employers. Between 1898 and 1901, as a consultant to the Bethlehem Iron Company, Taylor introduced all of his systems and vigorously pursued his research on the operations of metal-cutting tools. This experience, punctuated by controversy and escalating conflict with the company's managers, was the capstone of his creative career. Two features of it were of special importance. Taylor's discovery of high-speed steel, which improved the performance of metal-cutting tools, assured his fame as an inventor. In the meantime, his effort to introduce systematic methods in many areas of the company's operations forced him to take an additional step: to develop an integrated view of managerial innovation and a broader conception of the manager's role. By 1901, Taylor had fashioned scientific management from systematic management.

As the events of Taylor's career make clear, the two approaches were intimately related. Systematic and scientific management had common roots, attracted the same kinds of people, and had the same business objectives. Yet in retrospect the differences stand out. Systematic management was diffuse and utilitarian, a series of isolated measures that did not add up to a larger whole or have recognizable implications beyond day-to-day industrial operations. Scientific management added significant detail and a larger view. It was the first step toward the utopian vision of the 1910s. In 1901, when he left Bethlehem, Taylor resolved to devote his time and ample fortune to promoting his new conception of industrial management. His first report on his work, Shop Management (1903), portrayed an integrated complex of systematic management methods, supplemented by refinements and additions such as time study.

In the following years, as Taylor's reputation grew, he modified his presentation to make it more appealing. Two changes were notable. First, he began to rely more heavily on anecdotes from his career to emphasize the links between improved management, greater productivity, and social melioration to audiences that had little interest in technical detail. He liberally interpreted his records and recollections to make his point. His parable of "Schmidt", a laborer, who supposedly prospered because of an incentive wage, was largely apocryphal, but it captured the imaginations of legions of readers. Second, apart from the object lessons, Taylor spoke less about factory operations and more about the significance and general applicability of his ideas. Between 1907 and 1909, with the aid of a close associate, Morris L. Cooke, he wrote a sequel to Shop Management that became The Principles of Scientific Management (1911). Rather than discuss the specific methods he introduced in factories and shops, Taylor relied on colorful stories and language to illuminate "principles" of management. To suggest the integrated character and broad applicability of scientific management, he equated it to a "complete mental revolution".

Taylor's reformulation of scientific management was the single most important step in the popularization of industrial engineering. The Principles extended the potential of scientific management to nonbusiness endeavors and made Taylor a central figure in the "efficiency craze" of the 1910s. To engineers and nonengineers alike, he created order from the diverse prescriptions of a generation of technical writers. By the mid-1910s, he had achieved wide recognition in American engineering circles and had attracted a devoted following in France, Germany, Russia and Japan. His growing body of admirers at universities such as Pennsylvania State College, which introduced the first industrial engineering major in 1907, was another measure of the potency of his message.

Taylor also had a major influence on the diffusion of scientific management in industry. His insistence that the proper introduction of management methods required the services of an expert intermediary linked the progress of industrial engineering to the activities of independent consultants and accelerated the rise of a new profession.

1.3 The Role of the Consultant

Initially, the spread of systematic and scientific management occurred largely through the work of independent consultants, a few of whom, such as the accountant J. Newton Gunn, achieved prominence by the end of the nineteenth century. By 1900, Taylor overshadowed the others; by 1910, he had devised a promotional strategy that relied on a close-knit corps of consultants to install his techniques, train the client's employees, and instill a new outlook and spirit of cooperation. The expert was to ensure that the spirit and mechanism of scientific management went hand in hand. The formula did not always work smoothly, as many accounts have emphasized. Nevertheless, it produced a number of successful consulting firms and the largest single cluster of professional consultants devoted to industrial management.

Between 1901 and 1915, Taylor's immediate associates introduced scientific management in nearly two hundred American businesses, 80 percent of which were factories. Some of the plants were large and modern, like the Pullman and Remington Typewriter works; others were small and technologically primitive. Approximately one-third of the total was large volume producers for mass markets. A majority fell into one of two broad categories. First were those whose activities required the movement of large quantities of materials between numerous workstations (textile mills, railroad repair shops, automobile plants). Their managers sought to reduce delays and bottlenecks and increase throughput. On the other hand were innovative firms, mostly small, that were already committed to managerial reform. Their executives were attracted to Taylor's promise of social harmony and improved working conditions. A significant minority of the total fell in both categories.

Many of the textile mills, for example, were leaders in welfare work.

The records that have survived suggest that the consultants provided valuable services to many managers. They typically devoted most of their time to machine operations, tools and materials, production schedules, routing plans, cost and other record systems. Apart from installing features of systematic management, their most notable activity was to introduce elaborate production control mechanisms (bulletin boards and graphs, for example) that permitted managers to monitor operations. At the Franklin Automobile Company and a number of textile mills, the consultant's work consisted almost exclusively of improvements in scheduling and routing. Critics complained of excessive detail and red tape, but most executives expressed satisfaction with the engineers' work.

The records do not support the contention, common to many later accounts, that the experts' central concern was the work of the individual employee. In one-third of the factories, the consultant's activities generated such controversy that time and motion studies were never undertaken. Many workers in other plants were unaffected. At least one-half of the employees of the industrial companies must have been essentially onlookers. They may have experienced fewer delays, used different tools, or found that their supervisor's authority had diminished, but their own activities were unchanged.

What about those who were directly affected? Judging from the available evidence, neither Taylor nor his critics provided an accurate guide to the experts' activities. Supervisors lost much of their discretionary authority as they became subject to centrally imposed policies and regulations. Machine operators worked more steadily and performed fewer peripheral tasks. They also earned higher wages, though there were enough exceptions to blur the effect. Some unskilled jobs disappeared as improved scheduling and routing reduced the need for gangs of laborers and encouraged the introduction of materials handling machinery. But few firms embraced functional foremanship, which called for substituting specialists for the traditional supervisor, and even fewer tried to substitute management systems for the expertise of skilled operatives. While no systematic accounting is possible, improvements in production and costs resulted overwhelmingly from the elimination of delays and bottlenecks, improved communications, and the introduction or extension of wage incentives, not from new techniques of work or work organization.

Initially, at least, social harmony was more often a casualty than a consequence of scientific management. Supervisors opposed the erosion of their powers and autonomy, while production workers often resisted the introduction of time study. The proper use of time study became and remained a delicate issue. The consultants' promises of harmony and prosperity depended on the fair and "scientific" application of time study, but many workers suspected that it would be a pretext for rate cuts and lower wages. In many cases their fears were warranted. Labor disputes (and strikes at Water town Arsenal, Joseph & Feiss, and American Locomotive) resulted from the inability of many managers to resist the temptation to use time study for short-term cost cutting. Such abuses led to vigorous union campaigns against time study and incentive plans in the mid-1910s.

The contrast between the theory and practice of industrial engineering reflected several factors. The most obvious was the tradition of decentralized production management and the established web of interests that resisted innovation. A second factor was closely related: in most settings prior investment in machinery and other equipment limited the engineer's ability to introduce changes, regardless of the liberality of his or her mandate. An ideal arrangement would have required a new plant as well as new attitudes and responsibilities. A third element, ironically, was the role of the consultant, which contributed to a short-term, cost-cutting perspective. By definition a consultant was a transient, short-term employee. Taylor had proclaimed that a thorough reorganization required three or four years, but few of his successors had the temerity or financial security to make similar demands on their clients. They promised results and concentrated on goals that would justify their employment. Taylor's reliance on the consultant had been a way to accelerate the diffusion of his ideas. In practice, however, it undermined the likelihood of a "complete mental revolution".

Between 1910 and 1920, industrial engineering spread rapidly. Although large firms introduced staff departments devoted to production planning, time study, and other industrial engineering activities, the most notable development of those years was the proliferation of consulting firms. By 1915, the year of Taylor's death, he and his immediate followers no longer controlled the diffusion of his methods. Professional organizations, notably the Taylor Society (1910) and the Society of Industrial Engineers (1911), provided forums for the discussion of techniques and the development of personal contacts. But after brief and unsuccessful trials, they did not try to regulate entry to the profession or certify the competence of practitioners. Financial success and professional recognition increasingly depended on entrepreneurial and communications skills rather than technical expertise. Several of Taylor's closest associates, including Carl G. Barth and H. K. Hathaway, failed as consultants, while a new generation of practitioners, including many university professors who had had no direct contact with Taylor and whose credentials would have been viewed with suspicion a decade earlier, developed successful consulting practices.

Competition for clients and recognition-especially after the recession of 1920—1921 made executives more cost-conscious-produced other changes. Some consultants began to seek clients outside manufacturing. Spurred by the growing corps of academicians who argued that the principles of factory management applied to all businesses, they reorganized offices, stores, banks and other service organizations. A Society of Industrial Engineers survey of leading consulting firms in 1925 reported that many confined their work to plant design, accounting systems, machinery or marketing. A third trend was an increasing preoccupation with labor issues and time study. This emphasis reflected several postwar developments, most notably and ominously the increasing popularity of consultants who devoted their attention to cost cutting through the aggressive use of time study.

By the early 1920s, industrial engineers who worked in industry had divided into two separate and increasingly antagonistic camps. On the one hand were the pioneers and their heirs who viewed scientific management as an interrelated group of techniques that included increasingly sophisticated policies for managing production workers. Taylor and his associates had devoted little attention to labor issues apart from wage incentives. The attacks of labor unions and their political allies exposed the limitations of this approach, and the World War I economic boom showed that other personnel activities such as recruitment and training programs, representation schemes, and employee benefit plans were as important to improved economic performance as time study and the incentive wage. In the postwar years, the most influential group of industrial engineers, centered in the Taylor Society, embraced personnel management and combined it with orthodox industrial engineering to form a revised and updated version of scientific management. A handful of Taylor Society activists, and a few others, mostly owner-managers, implemented the new synthesis. They introduced personnel management and more controversial measures such as profit sharing, company unionism, and unemployment insurance that attacked customary distinctions between white-collar and blue-collar employees and enlisted the latter, however modestly, in the management of the firm.

A larger group emphasized the potential of incentive plans based on time and motion study and disregarded or deemphasized other features of orthodox scientific management. Their more limited approach reflected the competition for clients, the trend toward specialization, and the continuing attraction of rate cutting. Indicative of this tendency was the work of two of the most successful consultants of the post-1915 years, Harrington Emerson and Charles E. Bedaux. Emerson (1853—1931) was a restless, creative and flamboyant personality. Attracted to Taylor at the turn of the century, he briefly worked as an orthodox practitioner and played an influential role in Taylor's promotional work. He soon became a respected accounting theorist and a successful reorganizer of railroad repair facilities. As his reputation grew, however, he broke up with Taylor and set up a competing business with a large staff of engineers and consultants. Between 1907 and 1925, he had over two hundred clients. He also published best-selling books and promoted a mail-order personal efficiency course. He was probably the best-known industrial engineer of the late 1910s and early 1920s.

Emerson's entrepreneurial instincts defined his career. An able technician, he was capable of overseeing the changes associated with orthodox scientific management. He also recruited competent assistants, such as Frederick Parkhurst and C. E. Knoeppel, who later had distinguished consulting careers, and E. K. Wunnerlund, who became the head of industrial engineering at General Motors. But Emerson always viewed his work as a business and tailored his services to this customer's interests. In practice, this meant that his employees spent most of their time conducting time studies and installing incentive wage systems. By the mid-1920s, General Motors, Westinghouse, the Baltimore Ohio Railroad, Aluminum Company of America, American Radiator, and many other large and medium-sized industrial firms had introduced the Emerson system and in many cases an industrial engineering department staffed by former Emerson employees.

Bedaux (1886—1944) was even more adaptable. A French immigrant who was a clerk at a St. Louis chemical company in 1910 when an expert arrived to conduct time studies, Bedaux quickly grasped the essentials of time study and replaced the outsider. During the "efficiency craze" that followed the publication of The Principles, he found other clients. The turning point in his career came in 1912, when he accompanied several Emerson engineers to France as an interpreter. In Paris he struck out on his own, reorganized several factories, and studied the writings of Taylor and Emerson. Returning to the United States during World War I, he launched the Bedaux Company and began to cultivate clients. Bedaux rejected the promotional strategy that Taylor, Emerson, and Frank and Lillian Gilbreth, other Taylor disciples, had perfected. He gave no speeches, wrote no books or articles, avoided professional meetings, and never discussed his methods in public. Instead he relied on personal contacts and a simple, compelling promise: he would save more money than he charged. Although Bedaux employed able engineers and usually made some efforts to reorganize the plant, his specialty was the incentive wage. His men worked quickly, used time studies to identify bottlenecks and set production standards, installed a wage system similar to Emerson's, and explained their activities in incomprehensible jargon. Bedaux's clients included General Electric, B. F. Goodrich, Standard Oil of New Jersey, Dow Chemical, Eastman Kodak, and more than two hundred other American firms by the mid-1930s. His European offices were even more successful.

Bedaux's secretive approach makes it impossible to generalize about his services in the United States, but the records of his British subsidiary, recently opened, reveal a consistent effort to pressure workers for greater output. Whereas Taylor and his followers opposed wage cutting and "speed-up" efforts, Emerson was more flexible, and Bedaux made a career of forcing workers to do more for less. One notable result was a resurgence of strikes and union protests. By the 1930s, Bedaux had become infamous on both sides of the Atlantic. In response to his notoriety, he revised his incentive plan to increase the worker's share and dropped much of his colorful terminology, including the famous B unit. Bedaux's business survived, though neither he nor his firm regained the position they had enjoyed in the late 1920s and early 1930s.

Bedaux's unsavory reputation was a substantial burden for other industrial engineers. The growth of labor unrest in the 1930s and the frequent appearance of the "Be-do" plan on grievance lists revived the association of industrial engineering with labor turmoil. Regardless of their association with Bedaux and his tactics, industrial engineers became the targets of union leaders and their allies. In industries such as autos and tires, worker protests paralyzed the operations of industrial engineering departments and led to the curtailment or abandonment of many activities.

These problems were closely related to a longer-term threat to industrial engineering. The growth of labor unrest and government regulation of labor relations in the mid-1930s led many large industrial firms to create or strengthen personnel departments. In theory, industrial engineers and personnel and industrial relations experts subscribed to the same values and objectives. In practice, however, they were often antagonists and competitors. Apart from influencing wage, salary, and employee benefit policies, industrial relations managers had a strong intellectual and professional interest in maintaining stability on the antagonist. They helped curb the work of Bedaux and others like him, but they also resisted other changes that might lead to unrest? Managerial innovation became more difficult, and industrial engineers found themselves increasingly confined to activities that did not directly affect wages or working conditions.

1.4 Conclusions

During the first third of the twentieth century, industrial engineers successfully argued that internal management was as important to the health of the enterprise as technology, marketing, and other traditional concerns. Their message had its greatest impact in the 1910s and 1920s, when their "principles" won wide acceptance and time study and other techniques became commonplace. Managers whose operations depended on carefully planned and coordinated activities and reformers attracted to the prospect of social harmony were particularly receptive. By the 1930s, the engineers' central premise, that internal coordination required self-conscious effort and formal managerial systems, had become the acknowledged basis of industrial management.

Although the popularity of industrial engineering was due in large measure to the writings of Taylor and other pioneers, few executives took those statements literally or introduced all or most of the changes that Taylor and other industrial engineers advocated. Their customary approach was pragmatic and selective. This selectivity was apparent in their relations with consultants and in the work of corporate industrial engineering departments. It was also evident in the treatment of factory employees, the feature of industrial engineering that received the greatest attention. Time study techniques differed from firm to firm, with diverse effects, and incentive wage plans were equally varied in conception and application. In view of these tendencies, it is hardly surprising that industrial engineering had no consistent or predictable effect on the character of industrial work.

Industrial engineering thus contributed to the growing diversity of industrial management in the early twentieth century. Using techniques developed by proponents of systematic management, by Taylor and his followers, and by their successors of the 1920s and 1930s, industrialists were able to adjust their organizations to market pressures, technological innovations, and their conceptions of how a factory or business ought to perform. If they were unsure how to proceed, armies of eager consultants, of varying degrees of fidelity to the tenets of orthodox scientific management, were available to assist them. In the nineteenth century, few industrialists had recognized the potential of this form of internal coordination. By the 1930s, they took it for granted. Although the expansion of industrial relations activities in the late 1930s threatened to reverse this pattern and impose a new uniformity, it affected only a small percentage of plants and industrial workers before World War Ⅱ.

The variability in the practice of industrial engineering, evident from Taylor's day to the 1940s, greatly complicates any effort to assess its economic impact. In a minority of cases, it led to the realization of Taylor's original objectives and long periods of growth and prosperity. In other instances, it precipitated unrest, disruption, and organizational turmoil. In the majority of cases, however, it contributed in numerous ways, large and small, to improvements in manufacturing operations and firm performance. This mixed legacy, apparent by the eve of World War II, became the foundation for a second, more complex, and even more controversial chapter in the history of industrial engineering that extends to the present.

Professional Words and Expressions

antagonist　*n.* 敌手，反对者

assiduously　*adv.* 勤勉地，恳切地；孜孜不倦

bottleneck　*n.* 瓶颈

bureaucratic　*adj.* 官僚的，官僚主义的，官僚作风的

casualty　*n.* 受害者，受害方；伤亡人员

company union　公司工会运动

concomitantly　*adv.* 伴随地，并发地

cost accounting system	成本会计系统
cost cutting	削减成本
cost pressures	成本压力
craft knowledge	工艺知识
curtailment	*n.* 缩减,缩短,限制
disband	*vt. vi.* (使)解散,散伙;解体;遣散
Du Pont	杜邦公司
efficiency craze	效率热潮
empiricism	*n.* 实证论,经验主义,经验论
entrepreneurial	*adj.* 创业的,具有企业精神的;企业性质的
erosion	*n.* (权威、权利等的)逐渐丧失,削弱;侵蚀,腐蚀
fine-tune	调整,使有规则;对进行微调
flamboyant	*adj.* 引人注目的;炫耀的;时髦的
foreman	*n.* 工头,领班
idiosyncratic	*adj.* 特质的,独特的;特异反应的
incentive plan	奖励计划
Industrial engineering	工业工程
industrial-relations management	*n.* 工业关系管理
labor Turmoil	劳工动乱
mail-order	邮购,函购
managerial innovation	管理创新
mandate	*n.* 授权;委托;委任;命令
mental revolution	心理革命,精神革命
nonbusiness endeavor	非商业的努力
piece-rate system	计件工资制
pragmatic	*adj.* 讲求实效的;实用的;务实的
production schedule	生产进度表,产品明细表
professional consultant	专业顾问
promotional strategy	促销策略
proponent	*n.* 支持者,拥护者;提倡者
rate cut	利率削减,费用削减
resurgence	*n.* 复苏,复活;再起;回潮
routing plans	路由计划
scientific management	科学管理
selectively	*adv.* 选择性地
shop management	车间管理
shop-floor	车间
systematic accounting	系统会计
systematic management	系统化管理
temerity	*n.* 鲁莽,冒失,无礼
tenet	*n.* 原则;信条;教义
throughput	*n.* 吞吐量
wage incentive	激励工资
wage system	薪酬制度,工资体系

Notes

1. The attack on traditional management originated in two late nineteenth century developments. The first was the maturation of the engineering profession, whose advocates sought an identity based on formal education and mutually accepted standards of behavior and who rejected empiricism for scientific experimentation and analysis. The second development, closely related, was the rise of systematic management, an effort among engineers and sympathizers to substitute system for the informal methods that had evolved with the factory system.

19世纪末期,两个相关领域的进展对传统管理模式造成了重大影响。一是工业产业的成熟,表现为通过接受正规的教育和形成劳资双方可接受的行为标准两方面的工作确立了其

身份与地位,同时抛弃了工业实践中科学试验及分析的经验主义。二是系统管理方法的兴起,以及工程师及其支持者在寻求工业发展中所形成的非常规方法替代系统方面的努力取得了进展。

2. Taylor also had a major influence on the diffusion of scientific management in industry. His insistence that the proper introduction of management methods required the services of an expert intermediary linked the progress of industrial engineering to the activities of independent consultants and accelerated the rise of a new profession.

   泰勒对科学管理思想在工业界的传播起到了重要作用。他在企业引入合理的管理方法需要得到专家的指导上的坚持,间接地促使工业工程发展成为独立于企业经营的咨询活动,进而加速了这一新兴职业的兴起。

3. They introduced personnel management and more controversial measures such as profit sharing, company unionism, and unemployment insurance that attacked customary distinctions between white-collar and blue-collar employees and enlisted the latter, however modestly, in the management of the firm.

   他们引入了人事管理及一些备受争议的措施,如利润分享,公司工会运动,失业保险等。这些措施对人们已经习惯的白领和蓝领之间的差别带来了冲击,且在公司管理中使得蓝领阶层适度收益。

4. If they were unsure how to proceed, armies of eager consultants, of varying degrees of fidelity to the tenets of orthodox scientific management, were available to assist them.

   如果他们不能确定怎样继续下去,总可以得到那些程度不一但却忠诚于科学管理普遍原理的热诚的咨询工作人员的帮助。

5. The variability in the practice of industrial engineering, evident from Taylor's day to the 1940s, greatly complicates any effort to assess its economic impact.

   从泰勒时代到19世纪40年代的大量事实表明工业工程在实践中具有易变性,这使得任何评价其经济影响的努力都变的非常复杂。

Questions and Discussions

1. Describe the reasons that result in the vigorous union campaigns against time study and incentive plans in the mid-1910s.
2. What features of scientific management distinguish it from the systematic management? What is the relationship between them?
3. The consultant contributes much to the development of IE, how do you think theirs contribution?

2 Real IE Value 工业工程的真正价值

2.1 Introduction

Industrial engineers are great at solving problems. Ironically enough, there is still one age-old problem they are unable to solve identity, and the problem is not getting any easier to solve. In fact, "identity" is just one of several challenges currently facing the IE profession.

Today's competitive global economy and tighter corporate budgets are forcing IEs to deal with issues that were barely mentioned a decade ago. Companies are flattening corporate structures; IE departments are being eliminated or renamed; and universities and colleges are under even greater pressure to provide industry with graduates who are better trained to handle a much wider variety of job responsibilities.

On the other hand, today's IE has at his or her disposal more technology and tools than the IE of 30 years ago could have ever imagined. New technologies have improved accuracy and speed and generally have increased the IE's ability to cover a more diverse set of interests.

In addition, the IE now has a greater opportunity to concentrate on any one of a broad variety of areas that many companies now recognize as individual departments, including simulation, operations research, ergonomics, material handling and logistics.

2.2 The Name Game

What problems could possibly throw a shadow on such a bright array of opportunities? For starters, as new opportunities have developed for the IE, new questions have formed about what types of jobs the industrial engineer is qualified to perform.

At one time, it was easier to define what an IE did, "Industrial engineering was simple in those days when we dealt with methods, work standards and work simplification," says Carlos Cherubin, director of engineering for The Limited Co. "But there has to be some way to get past the old industrial engineering definition."

Even today, in many companies, IEs are still performing type of work that makes up what is now considered classical IE, "The big change is that the commercialization of a lot of these areas has turned them into 'niche thrusts'," says John Powers, director of the management service department at Eastman Kodak Co. While IEs have always been very adaptable to these "thrusts" as a skill set, he says, they are now competing for the headlines.

Jerry Zollenberg, director of IE for United Parcel Service says, "If a person loses slight of the total job and starts looking at the individual pieces, it comes out a little hairy." For example, Zollenberg says that he has an operations research (OR) group of 40 to 50 individual who are working on the cutting edge of computer technology. At one time these people were designated as IEs. But Zollenberg says that even though they are not called IEs, the job they are doing is certainly IE-oriented and could be IE, depending on how you set up the organization.

Like it or not, the trend today is specialization, and companies are following suit. Tough economic times are forcing many companies to redefine corporate structures, with a primary goal of flatting their organization in an attempt to cut costs and speed the decision-making process. In the case of the IE department, that trend has moved departmental names from the generic "IE" to special functions or areas that are being performed. Former IE departments have been decentralized or renamed and are now described using such terms as Quality Improvement Engineering, Management Service or Engineering Service, just to name a few.