INDUSTRIAL ORGANIZATION and MANAGEMENT

SIXTH EDITION

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PREFACE

Publication of the sixth edition of Industrial Organization and Management marks the text's 34th anniversary in print. Over the years it has tutored hundreds of thousands of students in the United States and it has been translated for use by students in other nations. The six editions have recorded the tremendous changes in industrial practices and technology which have occurred since World War II, while stressing the continued reliance on sound principles of management required to accomodate those changes. The original objectives of the text remain intact: "to present an overview of the operations of an industrial organization, the interrelationship of functions, and the fundamental principles of management which lead toward effective coordination and control."

The intent of the new edition is to survey the overall workings of industrial systems while highlighting the individual skills needed to make an enterprise work better. Implementation of this intent led to extensive revisions. Presentations in some areas are more succinct to allow greater coverage of recent developments. Added attention is devoted to managerial practices and techniques of general applicability. Interactions among consumers, government, and industry are explored to help anticipate industrial challenges of the 1980s.

The most prominent new feature is the addition of "Perspectives." Over a hundred short digests and discussions of special topics drawn from recent literature are spotted throughout the text. Some offer controversial opinions or expand on the conventional interpretation of operating policies. Others focus on current concerns critical to the long-term health of industry, such as

- coping with the paperwork explosion
- expectations for improving the quality of working life
- corporate ethics and white-collar crime
- the push for productivity
- effects of the consumer movement
- elimination of discrimination
- environmental protection and industrial growth
- conservation of resources, especially energy
- safety and social obligations of industry

In response to suggestions from users of the previous edition, subjects of less importance or those with which the reader is likely already familiar have been shortened. The result is a more compact renditian that overviews the

total production/distribution system, yet provides detailed operational considerations and procedures in the more immediately useful topics. The flow of subjects, following the introduction, progresses from *management structures* to *resource planning* to *production operations* to *personnel relationships* to *organizational control.* This chain links 20 chapters that successively develop the input-output sequences of industrial operations. Individual chapters start with a key-subject digest and end with student exercises, including review questions and cases for discussion.

As apparent from the foregoing, the theme for the book is still that created by Professors Bethel, Atwater, Smith, and Stackman. Credit for excerpts included in the Perspectives are owed to many authors and their publishers, primarily *Fortune, Harvard Business Review,* and *Industrial Engineering.* The resulting synthesis of time-honored subjects with recent advances and current concerns about future developments provides a challenging tour of the industrial scene.

May the journey be rewarding.

James L. Riggs

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INTRODUCTION: AMERICAN INDUSTRY

From its very beginning over 200 years ago, the United States has been engaged in a continuous social, technological, and scientific revolution. It has moved from water power to steam to electric to nuclear power; from handicraft to mechanical to automated to robotic mass production; through mineral, chemical, metallurgical, electronic, and miniaturization innovations; and the effects have spread over the world and into outer space. Despite the technological gains of other industrial nations, especially the U.S.S.R. and Japan, the United States still stands foremost in the volume of production, in the general application of science and technology to production, and in the wide distribution of goods and services among its people. How and why has this come about? What factors and influences shaped the American economy? How is the economy organized and controlled? How is American industry managed?

1 INTRODUCTION: AMERICAN INDUSTRY

1-1 MAJOR STAGES OF U.S. ECONOMIC GROWTH

In 1976 the United States of America celebrated its 200th anniversary. From its birth to now the country has passed through periods of hardship and prosperity, war and peace, insecurity and confidence, but with maturity came the powerful industrial muscle needed to support its stature as a world leader. Its development can be divided into six stages that span the period from the early colonial settlements of the seventeenth century to current times.

1-1.1 Colonial Industries

The earliest manufactures revolved wholly around the problem of subsistence in a raw unsettled country. Food and other agricultural production, lumbering, shipbuilding, and ship fitting heavily occupied the early colonists. But beside the woodsman's ax, the gun and trap of the fur gatherer, the farmer's plow, the fishing smack, and the whaler were the household and village shops of simple craftsmen who toiled to turn out the stern necessities and rarer luxuries demanded by a pioneer people.

1-1.2 Exploitation of Natural Resources

The second stage extended approximately from 1800 to 1860. It centered largely about the manufacture of goods to meet the demands of a fast growing population cut off by protective legislation from imports from abroad and the exploitation of natural resources opened up by settlers moving westward.

The first definitely protective tariff encouraging home manufactures was enacted in 1816, and in the same year the Second National Bank was set up for the further development of American sources of capital and credit. By the Constitution, free trade between the states held the way open for a brisk commerce as the different sections of the country were settled. Although agriculture predominated in the economy of the nation and furnished increasing exports to Europe, Americans turned with feverish energy to the development of all other natural resources with which the country abounded. Household industries and village shops continued to be the prevailing methods of conducting industrial operations but, as the period drew to a close, factory production rose in importance.

1-1.3 The Factory System

The major characteristic of the third stage of development is the expansion of the factory system until, by 1890, industry exceeded agriculture as the

dominant economic activity of the nation. The factory system brought the several processes of manufacture under one roof, centralized and increased the use of power, introduced specialized tools and machines, and hired workers for fixed wages and hours. Individual proprietors and partnerships owned the greater part of these enterprises, and capital came partly from the slow process of accumulation and partly from sources abroad. The exploitation of natural resources continued unabated all through this period, but of great significance was the shift in important industries away from dependence upon agricultural raw materials and over to the minerals and metals, particularly coal, iron, and steel. The growth of industry during this period was especially marked by technological developments: the great increase in inventions of products and processes, the wider use of steam engines as prime movers, the application of mechanical science to industrial processes, greater specialization in tools, machines, and labor, and the rapid expansion of the principle of interchangeable parts introduced successfully in America by Eli Whitney as early as 1798.

Natural increases in the population, augmented by waves of immigrants, furnished expanding markets and provided a growing labor force. Invested capital grew enormously, and more and more of it was being generated by the rapidly increasing economic activity within the country, while reliance upon foreign capital was reduced. In accumulating capital and making it available to producers, a change took place in the method of organizing enterprises. The incorporated company rose in importance compared to the simpler forms of individual and partnership enterprises. This development opened up larger possibilities for the further expansion of the principle of the factory system—the integration of industrial processes and the combination of enterprises.

1-1.4 The Spread of Scientific and Technological Innovations

The fourth stage constitutes an industrial revolution peculiarly American. What took place between 1890 and 1930 was much more than the further growth of the factory system; it was a complete transformation of the whole field of industrial production. By the introduction of new sources of power —notably the electric dynamo and the gasoline engine—power was specialized and brought to the work instead of the work having to be taken to the power, as was largely the case with steam. A whole series of new inventions came into wide everyday use, of which the telephone, automobile, motion-picture visual and sound apparatus, radio, airplane, and automatic machine tools are the most conspicuous end products. They revolutionized communication and transportation, amounting to a conquest of time and space hitherto undreamed.

The World War from 1914 to 1918 intensified the entire development. But the war also left a trail of maladjustments, particularly a decline in agricultural income, lack of balance between production and consumption,

and a speculative rise in securities, which by 1929 combined with an accumulation of other factors to cause the greatest depression the nation ever experienced.

Great change took place in production processes. By the science of time and motion studies; by the scientific arrangement of materials, machines, and processes; by the standardization of products; and by the redesign of factory buildings, the crude benchwork of the factory system was converted into the flexible assembly line of continuous mass production. Skill, precision, great power, multiple operations, and automatic controls were built into machines. The crude products of iron and steel were refined by the use of alloys, making metals lighter, more durable, and adaptable to wider uses. New chemical processes and products emerged from the laboratories that were rapidly being established in industry after industry.

Production was integrated and concentrated, bringing together under single management the many processes of manufacture from the raw materials to the finished products. This was obviously accompanied by greater combinations in the field of business organization. By almost every yardstick other than number of establishments, the corporation exceeded individual proprietorships and partnerships as the prevailing form of business organization. But more than that, the corporation itself, in many fields of industry, was merely a subsidiary unit in larger corporate structures such as the trust and holding company. Through outright merger and by other methods of business combination, many complementary and associated corporations were brought under one management. The largest companies in the most flourishing period of the simple factory system were dwarfed by the great industrial empires built up in the first quarter of the present century.

1-1.5 The Socioeconomic Revolution

A fifth stage, extending from the Great Depression of 1929 through the Korean conflict of 1950, marked a significant change in American economic development. During the depression years, when economic conditions failed to reach a new equilibrium capable of achieving recovery and full employment, the Federal government intervened in the economy on an unprecedented scale. No field of American life was untouched. The Federal government intervened in agriculture, industry, finance, state and local affairs, and for the health, welfare, and security of the people. It put the force of government behind the union organization of labor and took an active part in labor-management relations. Billions of dollars were spent on successive programs of "relief, recovery, and reform."

While the Federal government aimed at economic recovery and reemployment, its major accomplishment was to establish social-welfare measures so far-reaching as to amount to a socioeconomic revolution. With all its outpouring of money and its wide extension of government operations,

the "New Deal"[1] found no permanent solution for unemployment. Approximately 14 million persons were out of work in 1933, and after 7 years of extraordinary effort to solve the problem some nine million remained unemployed. Affairs were in this unsatisfactory state when war broke out in Europe in September, 1939. Entrance into the war against Germany, Italy, and Japan finally threw the United States into the high gear of production based on a war economy.

The production system in the war economy which finally emerged had the following characteristics: (1) outright abandonment of the production of civilian goods in many lines, especially the metals, and the subordination of all other civilian production to military preferences; (2) government-controlled production through a program of designated end-use products, supported by priorities and allocations of raw materials; (3) manpower allocation between civilian and military requirements by the Selective Service Administration, United States employment services, and through some indirect "freezing" of civilian workers in certain industries and areas; (4) price control and rationing of consumer goods; and (5) government supervisory direction and control over all associated elements of the economy in the interests of war. The goal sought was to organize the entire industrial system into one gigantic machine geared to maximum war production with the absolute minimum of civilian supply and maintenance.

Conditions in the postwar world gave little opportunity for peacetime economic relations. After a brief and incomplete attempt to convert from war to peace, the United States became involved in a "cold war" of defensive resistance to a militant communism spearheaded by Soviet Russia. From time to time this conflict flared up into hostile situations in Europe and Asia. It involved the United States and members of the United Nations in armed operations in Korea in 1950.

1-1.6 International Expansion and Domestic Consolidation

Many of the trends which started prior to 1950 have continued since then, often at an accelerated pace. A significant portion of the national budget was allocated to military expenditures for the cold war of the 1950s; these expenditures increased during the next decade for the hot war in Viet Nam and were still large in the 1970s. At the same time, foreign aid sent huge quantities of food, building, and military supplies to many countries. Occasionally the ebb and flow of exports resulting from shifting diplomatic relationships or national objectives caused domestic industrial disruptions. For example, the cutback in the space exploration program caused massive layoffs in the aerospace industry, and the grain sales to Russia

[1]The political slogan of the Franklin D. Roosevelt campaign in 1932 and successive years. For a detailed description of the times, see Charles A. Beard and George H. E. Smith, "The Future Comes: A Study of the New Deal" (1934), and "The Old Deal and the New" (1940), New York: The Macmillan Company.

in 1974 affected both food consumers and producers throughout the United States.

Economic conditions were generally healthy in the sixties and seventies, although depression tendencies appeared in 1960–1961, 1969–1970, and 1973–1974. The last recession period was particularly frustrating to economic planners in the government because prices rose or continued at high levels while employment dropped. Contrary to previous experience, lower demand by consumers during the business slowdown did not drag prices down commensurately, and government actions aimed at increasing business activity to relieve unemployment fueled more inflation. High rates of inflation throughout the world linger on to worry managers and influence their financial decisions.

Social obligations of American industry were affected in the 1960s and 1970s by legislation and changing public expectations. Some of the more significant influences are listed below.

1. Safety and health standards were established and enforced by new government agencies. So widespread were the regulations that nearly all segments of industry were affected.
2. Laws designed to protect the environment caused major expenditures by corporations and municipalities to limit or to correct pollution of water, air, and land.
3. Groups with ecological concerns successfully aroused public opinion to oppose both government and industrial activities. Products such as the supersonic transport were terminated in the development stage, and ecological safeguards were inserted in projects such as the Alaska pipe line.
4. Class-action law suits and consumer advocates forced more attention on the quality of products, their repair, and how they were advertised.
5. Efforts to eliminate discrimination due to sex, color, creed, age, and physical or mental disability resulted in modifications to personnel practices and facilities.
6. Workers' expectations for more satisfying jobs, in conjunction with legislative actions, frequently effected more pleasant work places and innovative management practices.

The growing awareness of resource limitations is having an ever greater effect on industrial operations and planning. Potential energy shortages stirred the most concern in the United States. Anticipated increases in fuel costs have spurred manufacturers to invest in fuel-saving facilities, distributors to reorganize supply channels, and nearly all organizations to initiate energy conservation programs. Automobile makers were directed by Congress to build cars that would travel more miles per gallon of gasoline. Industrial responses to resource shortages, such as the substitution of plentiful for scarce materials and extensive recycling or recovery of waste materials, will be critical management considerations for the rest of this century.

American companies operate all over the world. The movement of investment abroad began after World War II and was accelerated by military, economic, and technical aid programs devised to assist the war-devastated or developing nations. Expansion continued in order to exploit natural resources, to utilize low-cost labor, and to develop new markets available in foreign countries. In most cases, both the United States and the host countries benefited: the United States gained access to raw materials and profited from lower costs for imported products sold domestically, and the host countries were enriched by the access to new technology, jobs created by plant construction and operation, and currency earned from exports.

A result of international trading has been the growth of *multinational* companies. Such companies are typified by branches in many countries in which research, development, and manufacturing are conducted, and where the managers and stockholders represent several nationalities. The origin of multinationals can be traced to the great trading companies of the 18th century, but their present state of integrated, globe-encompassing activities has been fostered by a favorable political climate and the development of rapid worldwide communications.

Perspective 1A THE SHRINKING WORLD

In effect, technology has decreased the size of the world by increasing the speed of transportation and message transmission. The result has been more travel and trade between distant nations. Now major sporting events anywhere may become global television spectacles, and fads speed around the world almost as quickly as they start. The following statistics spotlight causes and effects of our shrinking globe.

	1950	1975–1976
A Trip to Europe (Washington, D.C. to London)	17 hours	3½ hours
Pieces of mail sent abroad from the United States	417 million	933 million
Telephone calls to and from the United States	900,000	50.5 million
Americans visiting overseas	651,000	7.7 million
Foreigners coming to the United States, excluding Canadian and Mexican visitors	288,000	4.4 million
Exports by free-world nations	$56 billion	$875 billion
Foreign direct investment in the United States	$3.4 billion	$26.7 billion
United States direct investment abroad	$11.8 billion	$133.2 billion

SOURCE: U.S. News and World Report, July 18, 1977.

COMMENT The quick and relatively convenient flow of money, products, styles, and information between nations has impacted American industry in many ways. Competition, both at home and abroad, is an obvious result, but more subtle economic and managerial concerns are also significant: trends originating abroad that affect consum-

ers and workers, knowledge made available by the exchange of students and consultants, irregular fluctuations of monetary values, coordination of activities made difficult by cultural differences, and many more.

1-2 BASIC ECONOMIC PROCESSES

Stripped of all detail, four major processes cover the material activities of people in any economic system: the primary raw-material industries, manufacturing, distribution, and the service industries (see Fig. 1–1).

First, there is the process that provides the raw materials needed in modern economy: the minerals and fuels; the grains and other vegetable and animal food products; wool, cotton, flax, and other fibers; lumber; stone, sand, and clay; leather, hides, and skin; and like commodities. This is the work of enterprises engaged in agriculture, mining, lumber-

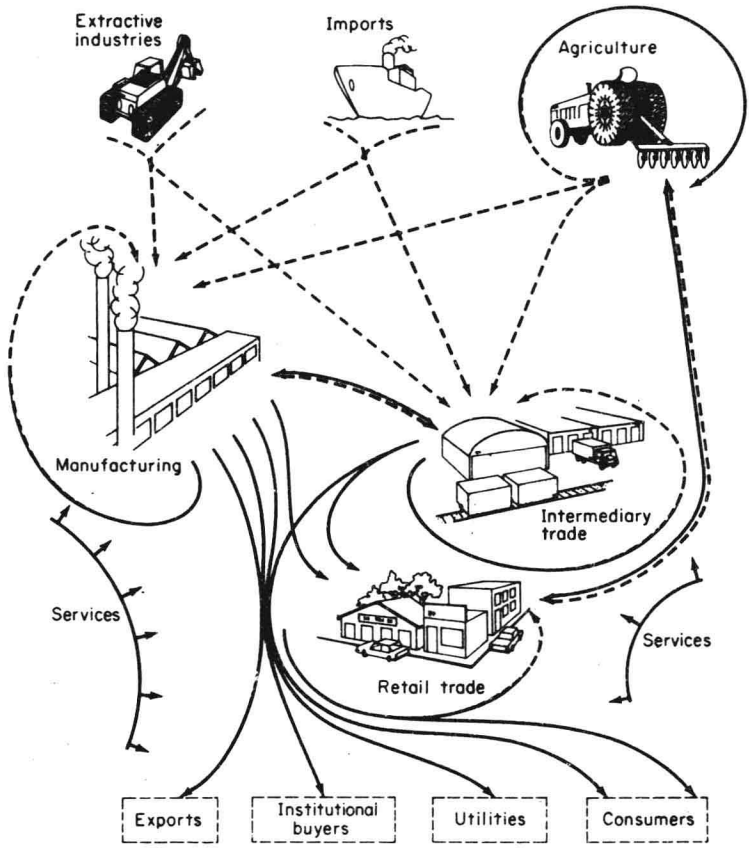


Figure 1-1 The economic process in the United States. General flow of production and distribution. Services are provided for all processes and trade.

ing, hunting, and fishing—often called the extractive, or "primary industries."

Second, there is the process by which these raw materials are manufactured or converted into different forms, i.e., the manufacturing process carried on chiefly in factory enterprises. The products turned out here fall into two general classes: semimanufactures, which are partly fabricated goods passing from producer to producer for further processing, and finished goods to be sold to the ultimate consumer. Thousands of enterprises carry on the manufacturing process.

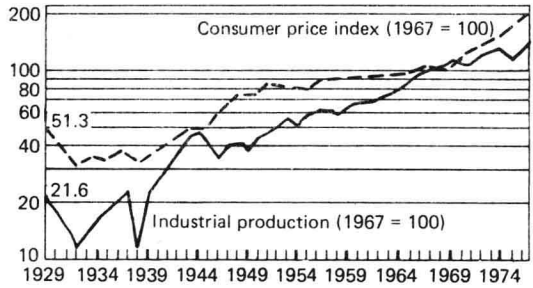
The third is the distributive process by which raw materials and manufactured goods are passed from producer to producer and from producers to consumers. Here are found the commercial and trading enterprises. They facilitate the passage of goods from the crude raw materials through the many stages of processing and manufacture to the ultimate consumers. In the main, their operations consist of buying and selling as middlemen, storing, sorting, grading, packaging, and moving goods about to places where they are most needed.

The fourth element—the furnishing of services in the economy—has rapidly grown to prominence in recent years. While many are thus engaged in producing and handling tangible goods, there are others who render an infinite variety of services at every point in the economic system: domestic services; financial and professional services to individuals and to business enterprises; mechanical services in factories and in the community; general public services such as transportation, communication, the furnishing of heat, light, and power, and similar services commonly classed as public utilities; and government services. Although the performance of services is not a process like agriculture and manufacturing, it is one of the four broad fields into which an economic system is divided.

Here, then, is the essence of economic life: people making goods and performing services while in turn they use the products and benefit by the services of others. The need for organizing economic life springs from the fact that man's wants are unlimited, but the means of satisfying those wants are scarce. The material basis of daily living is thus a cooperative cycle of making and using goods and services. All four fields of economic activity are mutually dependent parts of the larger whole, the national economy. And because the nation is not a self-sufficient economic unit, it carries this cooperative cycle beyond its borders by taking part with other nations in the international exchange of goods and services.

Perspective 1B PRODUCTION GOES UP, BUT SO DO PRICES

The total output of American factories, mines, and utilities, as shown by the solid line in the chart, has gone up quite steadily since the depths of the depression in the 1930s. However, consumer prices have also risen, as indicated by the dashed line, and in recent years the rate of increase has been a cause of alarm.



COMMENT Industrial production is a pivotal factor in the economic health of the nation. It provides employment and income. In 1977 employment was at an all-time high, but unemployment was over 7 per cent, a level considered to be too high. Average income has increased by about 130 per cent (corrected for inflation) since the thirties to nearly $6,000 per person after taxes, but there are still too many people with incomes below the poverty level. Inflation affects both the public and the producers in their decisions about what to buy, when to buy, how much to buy, and why certain items should be bought rather than others.

1-3 INDUSTRIAL ENTERPRISE

Having glanced briefly at the economic system as a whole, we pass now to the important but narrower field with which this book is concerned. Of the four great processes which together form the framework of the economic system, we are primarily concerned with the field of the manufacturing industries, or "industrial enterprise," as it is commonly called. What is industrial enterprise? *Guided by management, an industrial enterprise combines land, labor, and capital in variable proportions to make a producing unit turning out tangible goods.*[2]

The essence of industrial production is the transformation by factory methods of raw materials into things wanted by society. Industries are divided into broad classes according to the nature of the industry, the use made of the product, and the amount of service obtained from the product before it is consumed or becomes unfit for further use. Thus, industries which manufacture materials, tools, machines, and equipment for use in the operations of other factories are *producer-goods industries.* Those which turn out products intended for direct use of the people in daily living are *consum-*

[2]The term "land" covers not only "standing room," i.e., physical location of industrial plant, but also natural resources (natural raw materials), character of the soil, rainfall, temperature, the earth's waters, and other features associated with land. "Labor" includes brainwork, manual work, and all the characteristics of individuals engaged in personal services. "Capital" refers chiefly to buildings, tools, machines, equipment, and materials, produced by man and used in further production. In common use, capital often lumps together land, money, buildings, equipment, and materials as being the total investment in an industrial enterprise.

er-goods industries. Each is further classified as *durable-goods, nondurable-goods,* and *semidurable-goods* industries. A durable item, like a dynamo, an automobile, or a watch, provides service over a long period of time. Nondurable goods, like industrial catalysts or fuel, are used up in one or a few operations. The semidurable goods fall in between. The type of goods produced is especially important to management. It strongly influences, as we shall see in many chapters of this book, the organization, finances, business policies, labor supply, production methods, marketing channels, and general prosperity of the industrial enterprise.

Within the field of industrial enterprise we see hundreds of thousands of producing units at work. These units vary in form of ownership and in the way they are organized for operation. A knowledge of this basic industrial structure is essential to successful management of an enterprise because it largely determines the conditions of production.

1-3.1 Division of Labor and Specialization

The entire field of industrial activity, like the economic system as a whole, is pervaded by the principle of division of labor and its refinement, specialization. In its simplest form, division of labor means dividing up the work on the principle that different people and different places are best fitted for different things depending on influences stemming from geography, natural conditions, personal aptitudes, and skills. Specialization is a refinement of this principle and is carried furthest in the manufacturing industries. Land is put to special uses; labor to minutely specialized tasks; buildings, tools, and machines to particular operations. Within the single establishment there is specialization in organization and function, subdivision of activities by departments and sections, and further specialization by process and by operation until a single machine, tool, or worker performs a minute task exclusively. The latest development—automation—integrates several such specialized tasks or operations into single units (such as multiple-operation machines) and groups machines and processes together in a line or sequence automatically controlled by mechanical and electronic devices.

Specialization yields enormous benefits in greater quantities of goods in less time and with less effort, wider varieties, better quality, less waste, more efficient employment of land, labor, and capital, and generally rising standards of living. Specialization has its disadvantages, too. It depends upon the extent of the market and upon the smooth flow of goods between markets (trade). But chiefly it creates a dependence not only within the economic system and among industries, but among all departments, sections, processes, and operations within a single enterprise, which makes the enterprise (and often the entire economy, as in depressions) vulnerable to miscalculations and disruptions.

These facts have significance in the field of industrial management. Upon management and those who share in the responsibility for industrial operations falls the burden of discovering the extent to which specialization can