

# The domain of production and operations management and the role of Elwood Buffa in its delineation

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Available online 2 August 2006

## Abstract

Production and operations management (POM), as we know it today, was established in the 1960s in response to various drivers. Elwood Spencer Buffa first published his textbook, *Modern Production Management*, in 1961. He had degrees in business and engineering and had worked as an industrial engineer. He was also part of the UCLA–RAND academic complex whose operations researchers coined the term *management science* and conceived the idea of The Institute of Management Sciences. Buffa coined the term *operations management* and consolidated knowledge from various streams of production management, including operations research and industrial engineering, into a coherent managerial framework.

Modern business education had started to emerge around 1959 after reports from the Carnegie Corporation and the Ford Foundation recommended improving research and analytical approaches. Many business schools created courses in POM. At the time, no single book covered what we now call production and operations management. The POM faculty at most business schools, including Columbia's Graduate School of Business, adopted Buffa's book enthusiastically when they introduced courses in "production management". Buffa was an extraordinary visionary who covered supply chain management, design for manufacturing, quality management, service operations, and computer applications and the automated factory. The POM community pursued these issues more actively 2 or 3 decades later.

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**Keywords:** Automation; Buffa; Domain of production and operations management; Engineering/operations interface; Evolution of production and operations management; Product development; Quality management; Supply chain management

## 1. The genesis and the early evolution of production and operations management: until 1945

### 1.1. The Industrial Revolution and Adam Smith

Although the field of operations is as old as civilization, it was articulated in the context of industrial production only after the 1600s (Baber, 1996, Chapter 3 and Landes, 1998, Chapters 11 and 13). At the beginning of the Industrial Revolution, which was driven by a

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complex set of economic and military factors (Singhal, 2001), Smith [1776](1937) laid the foundation of economics and production management. About 50 years later, Babbage (1832) wrote about a wide range of topics, including time studies, research and development, and economic analysis for location decisions.

### 1.2. The emergence and growth of the corporation and of production and operations management: 1880–1932

About a century after its birth, the Industrial Revolution began to spread in the United States, and three sets of developments occurred between 1880 and 1920. First, people made a sustained effort to systematize and standardize such items as machines and machine tools, measurement, nomenclature, fittings, screws, nuts, and bolts. Their goal was to enhance objectivity in engineering work, to eliminate duplication, to reduce accidents resulting from incompatible meshing parts, and to cut costs. Second, they developed (Harris, 1913, 1915; Litterer, 1961a,b, 1963, 1986; Shenhav, 1995; Taylor, 1885, 1903, 1911; Yates, 1989) cost accounting systems, administrative procedures, a measure economic order quantity (Harris, 1913, 1915), production control systems, scientific management (Taylor, 1885, 1903, 1911), and standardized communication. Mechanical engineers, whose numbers increased 60 times between 1880 and 1920, the American Society of Mechanical Engineers (ASME), and four publications (the *American Machinist*, the *Engineering Magazine*, *Factory: The Magazine of Management*, and the *Transactions of the ASME*) led the efforts on these developments (Shenhav, 1995).

Third, large firms in the chemical and electrical industries, including AT&T, Du Pont, Eastman Kodak, General Electric, and Westinghouse, pursued industrial research and development. It was a natural extension of systematization and scientific management. “Like Taylor on the shop floor, the engineer-managers that guided these companies believed that systematic investigation and the focused application of knowledge could result in better products and processes” (Hayes et al., 1988, p. 41). By the 1920s, professional managers managed production in multi-unit, large-scale firms (Chandler, 1977).

After 1920, Ford developed the assembly line (Ford and Crowther, 1922); Dodge, Romig, and Shewhart worked on quality (Dodge, 1928; Dodge and Romig, 1929; Shewhart, 1931); and Dickson, Mayo, and Roethlisberger studied work environment at the

Hawthorne plant of the Western Electric Company in Chicago (Whitehead, 1938; Roethlisberger and Dickson, 1939; Mayo, 1933, 1946). The Hawthorne findings “suggested that the influences of various physical and structural characteristics of work setting cannot be properly understood as independent influences, but rather must be considered components of a larger social system” (Sonnenfeld, 1985).

### 1.3. Production and operations management comes to higher education

The developments in factories and laboratories were echoed in business and engineering education, and a number of business schools were founded. In 1904, Dexter Kimball, dean of engineering at Cornell, introduced a course on works administration and advocated “the extension of the principles of standardization to the human element in production” (Kimball, 1939 and Noble, 1977, p. 83). Between 1909 and 1914, Taylor lectured at the Harvard Business School in the course titled, Industrial Production. Carl Barth, one of Taylor’s disciples, also lectured at Harvard between 1911 and 1922. In October 1911, Harlow Person, dean of the Tuck School of Business at Dartmouth, invited Taylor, Lillian Gilbreth, and 300 other leaders from industry to the first conference on scientific management, launching the worldwide scientific management movement [<http://www.tuck.dartmouth.edu/about/history/index.html>]. The Hawthorne studies were performed by faculty members in the production department at Harvard. The U.S. War Department, which essentially took over Harvard’s curriculum, split the production department into two groups: production management (war production) and administration (what we now know as human resources management and organizational behavior).

Anderson (1928) of the University of Illinois published *Industrial Engineering and Factory Management*, focusing on works administration and shop management. He later revised the book in 1942 as *Industrial Management*, broadening the coverage of the functions of management. Some business schools called the subject production management. At that time, most operations-related courses in business schools were not very rigorous. In 1928, Marshall, a former dean of the University of Chicago business school, wrote, “Within the field of technical business education, there has often been such proliferation of ‘courses’ that it is scarcely humanly possible that the content can be of university or professional grade” (Uselding, 1981).

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