1.5: Development of Operations Management

Operations in some form have been around as long as human endeavor itself but, in manufacturing at least, it has changed dramatically over time, and there are three major phases – craft manufacturing, mass production and the modern period. Let's look at each of these briefly in turn.

Craft manufacturing

Craft manufacturing describes the process by which skilled craftspeople produce goods in low volume, with a high degree of variety, to meet the requirements of their individual customers. Over the centuries, skills have been transmitted from masters to apprentices and journeymen, and controlled by guilds. Craftspeople usually worked at home or in small workshops. Such a system worked well for small-scale local production, with low levels of competition. Some industries, such as furniture manufacture and clock-making, still include a significant proportion of craft working.

Mass production

In many industries, craft manufacturing began to be replaced by **mass production** in the 19th century. Mass production involves producing goods in high volume with low variety – the opposite of craft manufacturing. Customers are expected to buy what is supplied, rather than goods made to their own specifications. Producers concentrated on keeping costs, and hence prices, down by minimizing the variety of both components and products and setting up large production runs. They developed aggressive advertising and employed sales forces to market their products.

An important innovation in operations that made mass production possible was the system of standardized and interchangeable parts known as the "American system of manufacture" (Hounshell, 1984), which developed in the United States and spread to the United Kingdom and other countries. Instead of being produced for a specific machine or piece of equipment, parts were made to a standard design that could be used in different models. This greatly reduced the amount of work required in cutting, filing and fitting individual parts, and meant that people or companies could specialize in particular parts of the production process.

A second innovation was the development by Frederick Taylor (1911) of the system of 'scientific management', which sought to redesign jobs using similar principles to those used in designing machines. Taylor argued that the role of management was to analyze jobs in order to find the 'one best way' of performing any task or sequence of tasks, rather than allowing workers to determine how to perform their jobs. By breaking down activities into tasks that were sequential, logical and easy to understand, each worker would have narrowly defined and repetitious tasks to perform, at high speed and therefore with low costs (Kanigel, 1999).

A third innovation was the development of the moving assembly line by Henry Ford. Instead of workers bringing all the parts and tools to a fixed location where one car was put together at a time, the assembly line brought the cars to the workers. Ford thus extended the ideas of scientific management, with the assembly line controlling the pace of production. This completed the development of a system through which large volumes of standardized products could be assembled by unskilled workers at constantly decreasing costs – the apogee of mass production.

The modern period

Mass production worked well as long as high volumes of mass-produced goods could be produced and sold in predictable and slowly changing markets. However, during the 1970s, markets became highly fragmented, product life cycles reduced dramatically, and consumers had far greater choice than ever before.

An unforeseen challenge to Western manufacturers emerged from Japan. New Japanese production techniques, such as total quality management (TQM), just-in-time (JIT) and employee involvement were emulated elsewhere in the developed world with mixed results. More recently, the mass production paradigm has been replaced, but there is yet no single approach to managing operations that has become similarly dominant. The different approaches for managing operations that are currently popular include:

- **Flexible specialization** (Piore and Sabel, 1984) in which firms (especially small firms) focus on separate parts of the value-adding process and collaborate within networks to produce whole products. Such an approach requires highly developed networks, effective processes for collaboration and the development of long-term relationships between firms.
- **Lean production** (Womack et al., 1990) which developed from the highly successful Toyota Production System. It focuses on the elimination of all forms of waste from a production system. A focus on driving inventory levels down also exposes inefficiencies, reduces costs, and cuts lead times.

- **Mass customisation** (Pine et al., 1993) which seeks to combine high volume, as in mass production, with adapting products to meet the requirements of individual customers. Mass customisation is becoming increasingly feasible with the advent of new technology and automated processes.
- **Agile manufacturing** (Kidd, 1994) which emphasizes the need for an organization to be able to switch frequently from one market-driven objective to another. Again, agile manufacturing has only become feasible on a large scale with the advent of enabling technology.

In various ways, these approaches all seek to combine the high volume and low cost associated with mass production with the product customization, high levels of innovation and high levels of quality associated with craft production.

Table 1.5.1: A chart summarizing characteristics of craft manufacturing, mass productions, and the modern period.

	CRAFT MANUFACTURING (PRIOR TO LATE 1800)	MASS PRODUCTION (LATE 1800-1970)	THE MODERN PERIOD (1970-PRESENT)
PRODUCTION	Low volume	High volume	High volume
VARIETY	Maximal	Minimal	Dependent on company's goals
FOCUS	Meet specific requirements of customers	Low costs and prices, standardization of materials and production	Low costs, adaptability within market, innovation, high quality
WORKERS	Highly skilled and specialized individuals	Many (usually unskilled) individuals with narrowly defined tasks	Dependent on company's goals
FACILITY	Home or small workshops	Fixed locations with assembly lines	Dependent on company's goals
COMPETITION	Low	High	Very high