MLab
The Management Lab

Scientific Management

Creating efficient work processes is an abiding obsession for managers. Witness the fascination in the 1990s with re-engineering and more recently with outsourcing. Maximising outputs and controlling inputs lies at the heart of management concerns.

In the late 19th century these issues had hardly been identified, let alone examined. Frederick Winslow Taylor changed this through the observation of his fellow workers. His starting point was the identification of a number of problems. Taylor noticed that workers engaged in what was then called "soldiering". Instead of working as hard and as fast as they could, they deliberately worked slowly. They had no incentive to go faster or be more productive. Furthermore, it was in their interest, Taylor said, to keep their employers ignorant of how fast work could be done. "Nineteen out of twenty workmen throughout the civilised world firmly believe that it is for their best interests to go slow instead of to go fast. They firmly believe that it is for their interest to give as little work in return for the money that they get as is practical," Taylor wrote.
Taylor went on to identify another crucial problem: the workers had a notable advantage in that their superiors had no idea how long a job should take. Irritated by such brazen inefficiency, and believing it was morally wrong to waste any resources, Taylor set to work. Armed with a stopwatch, he set out to study the nature of people's work by examining exactly what was taking place and how long it took. Taylor surmised that such a minute examination of a task would enable the observer to establish the best means of carrying out a given job. A single, preferred, efficient means of completing the task could then be established and insisted on in the future. This was the basis of what he labelled scientific management.

The Inspiration

Taylor was born in Germantown, Pennsylvania, on March 20, 1856, into an affluent Philadelphia family. His father was a lawyer from an old Pennsylvania Quaker family and his mother, Emily Winslow, from an old New England Puritan family. Her father was a New Bedford whaler, but Emily was at the forefront of new thinking – a prominent anti-slavery agitator and a campaigner for women's rights.

Taylor had strong European connections. He was educated in France and Germany and travelled throughout Europe before eventually returning to the Phillips Exeter Academy in New Hampshire.

However, despite his well-heeled background, Taylor began his working life at the bottom of the engineering ladder. He initially worked as an apprentice at the William Sellers Company in Philadelphia, and in 1878 went to work at the Midvale Steel Company. At Midvale, Taylor began as a clerk, though he soon moved down the company's ranks to become a labourer. At this time of his life he undertook a range of roles. In six years at Midvale he was keeper of tool cribs, assistant foreman, foreman, master mechanic, director of research, and finally chief engineer of the entire plant. While working he also re-activated his academic career – he had been destined for Harvard before poor eyesight reputedly intervened – and spent three years from 1880–83 studying engineering at evening classes at the Stevens Institute. He stayed at Midvale until 1889, and it was his observations there that formed the basis for his scientific management theories.

Taylor was a man of devotedly practical intent, the ultimate problem solver. In an age that produced more than its fair share of dilettantes, Taylor was a veritable Renaissance man. The breadth of his insights and interests is, even now in an age of hyperbole, astonishing. His restless inventiveness spawned over 40 patents and made

him a fortune. These covered everything from a revolutionary “Power Hammer”, built for the Midvale Steel Company in the late 1880s, to an apparatus for grinding balls (1900) and from the 1907 “combined hothouse grapery and greenhouse” to 1909’s “Apparatus for Moving Growing Trees and the Like”.

Another insight into his energetic approach to life was the way he tackled sport. Although he may not have been a wonderfully gifted athlete, Taylor brought both dogged determination and inventiveness to all his endeavours. In 1881 he won the doubles at the US tennis championships – but, not content with that, he then designed his own tennis racket, which resembled a spoon, and his patent pageant also included a lawn tennis net (Patent No. 401,082 issued April 9, 1889).

Then he turned his mind to golf. As do many players, he encountered problems with his putting and, attempting to sort out the problem through his own inventiveness, he developed a Y-shaped putter (Patent No. 792,631; June 20, 1905). Putting obviously took hold in Taylor’s imagination because he then started looking at putting greens and began experimenting with the grass on the greens at his family home. In the pre-sprinkler age, greens were unpredictable because they relied on rainfall, and Taylor believed the problem could be solved by developing a green which was fed by water from below the surface of the soil.

This level of committed endeavour was typical of Taylor’s approach. He had a passion for order and efficiency and revelled in the neatness of Dewey's classification and subject index for libraries. “He was not the steam roller that some people like to represent him,” said one of disciples, Henry Gantt, “but he did believe that a strenuous life was the life worthwhile, and that it not only brought more financial compensation, but that it added to the usefulness and happiness of men.”

As with many great inventors one of Taylor’s defining qualities was his persistence. When, in 1906, he presented his paper, "On the Art of Cutting Metals," to the American Society of Mechanical Engineers, it was the result of 26 years of experimentation. Taylor’s experiments involved cutting over 800,000 pounds of steel and iron into chips with experimental tools. Records were kept of some 30,000 to 50,000 experiments costing the then enormous sum of between $150,000 and $200,000.

Taylor “promised to use ‘science’ to increase profits, get rid of unions, increase the thrift and virtue of the working classes, and rise productivity to the point where society could enter a new era of harmony based in the high consumption of mass-produced goods by the previously deprived classes”. In this pursuit he put his faith in those analytical tools that would provide precise measurements and levers for the control of production.

Experimentation

As referred to earlier, Taylor’s “science” (which he described as “seventy-five per cent science and twenty-five per cent common sense”) came from the minute examination of individual workers’ tasks. He made careful experiments to determine the best way of performing each operation and the amount of time it required, analysing the materials, tools, and work sequence and establishing a clear division of labour between management and workers.

Such an approach anticipated the rise of reductionism – the belief that if a problem can be reduced to its smallest component, and that component understood, then it is possible to comprehend the whole. A famous example of this thinking involved a theoretical pig iron handler called Schmidt.

Working in the most efficient manner, Taylor calculated that Schmidt could load 47 tons a day rather than the usual 12½ tons. Such precise calculations of productivity, he believed, meant that workers would know exactly what was expected of them and that managers would know exactly how much should be produced. It also meant that more accurate piecework rates could be set with more reliable bonuses and penalties.

Such experiments laid the groundwork for the principles of scientific management which were first published in 1911. These included time studies, standardization of tools and implements, standardisation of work methods and the use of “slide-rules and similar

time-saving devices". Taylor called these elements "merely the elements or details of the mechanisms of management" and he saw them as extensions of the following four principles of management:

- The development of a true science
- The scientific selection of the workman
- The scientific education and development of the workman
- Intimate and friendly cooperation between the management and the men

Or put another way: "It is no single element, but rather this whole combination, that constitutes scientific management, which may be summarised as:

- Science, not rule of thumb
- Harmony, not discord
- Cooperation, not individualism
- Maximum output, in place of restricted output
- The development of each man to his greatest efficiency and prosperity."

Taylor was also aware, however, of the risks involved in what today we would describe as culture change. He stated the importance of management commitment and the need for gradual implementation and education in any reform. "The really great problem" involved in the change "consists of the complete revolution in the mental attitude and the habits of all those engaged in the management, as well of the workmen."

Taylor's system of management took him 15 to 20 years to develop. At Midvale his experiments involved piecework backed by a special accounting system, techniques for the systematisation of machine shops, experiments in metal-cutting, and a plan for "functional foremanship" that gave quasi-professional independence to foreman-specialists. Then, after he had left Midvale and accepted a job at Bethlehem Steel, he worked with metallurgist Maunsel White and developed the Taylor-White Process for treating tool steel, which revolutionised metal cutting and enabled the development of mass production techniques.

Validation

Taylor's ideas were especially successful because it was easy for captains of industry to see what a difference they were making to costs and productivity. For example, the introduction of his ideas at the Watertown Arsenal reduced the labour cost of making certain moulds for the pommel of a packsaddle from $1.17 to 54 cents and the labour cost of building a six-inch gun carriage fell from $10,229 to $6,950.

The logic was simple. Measurement ensured that everyone knew what he or she had to do and this increased production. Furthermore, increased production was achieved with lower costs and this led to bigger profits.

While this was the upside of the coin, however, Taylor's system was far from trouble-free. Midvale eventually went broke in 1893. When he worked at the Bethlehem Steel Company, Taylor found that many of the wide-ranging changes he implemented were both unsuccessful and unpopular, and they eventually led to his dismissal from the company in 1901.

There was also resistance to Taylor's ideas from both management and workers. In some cases the management resistance had its roots in power struggles as younger managers tried to implement reform without the willing consent of their older colleagues. But the opposition of labour was, typically, more intense. If the first task of Taylor in the shop was "to break the power of the foremen", the immediate response of the foremen was "mass resignation, violence, and threats of violence".

However, Taylor's ideas were not to be stopped and were picked up by, among others, Henry Ford, who used them as the basis for his model of mass production.

Ford had created a manufacturing process in which cars mounted on cradles were pushed from one workstation to the next, while workers swarmed around them assembling components. To fill demand for the Model T, Ford had to scrap this system. In 1913, he redefined the work to stop the swarming. "The man who puts in a bolt does

not put on the nut; the man who puts on the nut does not tighten it," said Ford. Partially assembled cars were also roped together so they could be pulled past the workers at a predictable speed. In a single year, production doubled to nearly 200,000 while the number of workers fell from 14,336 to 12,880. The forerunner of the modern assembly line was born, and Taylor was its true innovator. Peter Drucker cited Taylor's thinking as "the most lasting contribution America has made to Western thought since the Federalist Papers." Taylor's influence, he suggested, was greater even than Henry Ford. The assembly line was simply a logical extension of scientific management.

Dissemination

Scientific management was a major innovation, and Taylor spoke to large audiences – especially in Europe – about his groundbreaking ideas. As Lyondell Uric, the British champion of scientific management, noted in 1956: "At the time Taylor began his work, business management as a discrete and identifiable activity had attracted little attention. It was usually regarded as incidental to, and flowing from knowledge-or-acquaintance-with, a particular branch of manufacturing, the technical know-how of making sausages or steel or shirts."

No longer was this case. Taylor made management worthy of study. But do his ideas still have credibility today?

Looked at from one perspective, his thinking appears crude. His reductionism approach has been credited with destroying the soul, turning men into automatons and dehumanising the workplace. Specifying exactly what work needs to be done, exactly how it is to be done and the exact time allowed for doing it echoes some of the complaints being made about today's worst employer practices. Furthermore, critics also point to Taylor's negative view of workers – that they deliberately planned to do as little work as they could – as out of step with what we now understand about human needs and motivation.

However, you only have to scratch the surface to see that Taylorism is still very much with us. As a 1997 Fortune article noted: "Taylor's influence is omnipresent. It's his ideas that determine how many burgers McDonald's expects its flippers to flip or how many callers the phone company expects its operators to assist." And although they may not know it, all management consultants can also look to Taylor as being the first to recognise that there was a distinct role for the independent expert separate from the front line business manager.

Further Reading

Thomas A. Stewart, Alex Taylor, Peter Petre, and Brent Schlender, "The Businessman of the Century", Fortune, 22 November 1999.

Frederick Winslow Taylor, The Principles of Scientific Management, First World Library, Ltd., 2005.