THE EVOLUTION OF SCIENTIFIC MANAGEMENT

Dimitrios Nikolaou Koumparoulis
UGSM-Monarch Business School,
SWITZERLAND.
dr.koumparoulis@ugsm-monarch.com

Anathalia Vlachopoulioti
UGSM-Monarch Business School,
SWITZERLAND.
anathaliav@gmail.com

ABSTRACT

Frederick Taylor is known as the father of modern management. Taylor's scientific management revolutionized industry and helped shape modern organization. Scientific management revolutionized industry because it explains how to increase production by working smarter, not harder. Taylor's ideas were not limited to only serving the company's bottom line but the increase in productivity benefited the workforce as well. The principles of scientific management became a machine of universal efficiency since there was a widespread use of scientific management worldwide and beyond the scope of the workplace. Taylor's theories on using science and statistical fact have become a guideline that many have followed to great success.

Keywords: Frederic Taylor, scientific management, productivity, organization, output.

INTRODUCTION

Frederick Taylor, known as the father of modern management, was born into an affluent Philadelphia family, and studied engineering at Steven's Institute of Technology in New Jersey. Taylor began his career as an apprentice foreman and common laborer. He would quickly advance to chief engineer. His direct observations of men at work led him to develop what is known today as "motivation" theory, although this is a psychology term that would not be imported into the management vocabulary until much later.

Taylor called this method scientific management. Taylor's own point of view, although benign towards workers, saw human labor very much analogous to machine work--- something to be "engineered" to achieve efficiency. His theories on management are promoted worldwide (and maybe took stronger root in Japan than in the U.S. or Europe) and would be controversial at home. (mgmtguru.com)

In 1903, Taylor wrote Shop Management where he discussed his management principles. In it, Taylor theorized that workers were inefficient because they tended to ration their workload or work less than they could to prevent the job tasks from running out, resulting in a loss of wages. Management also failed to structure work effectively and to provide appropriate incentives. (mgmtguru.com)

Taylor would later elaborate on his management theories in 1911, when he published The Principles of Scientific Management. Scientific management consisted of four basic principles:

1. Replace "rule of thumb" work methods with methods based on a scientific study of the tasks.
2. Scientifically select and then train, teach, and develop the workman.
3. Provide detailed instruction and supervision of each worker in their given task
4. Divide work nearly equally between managers and workers, so that the managers apply scientific management principles to planning the work and the workers actually perform the tasks.

These principles clearly defined the workforce. Workers were charged with the physical labor and management was given legitimate authority to discern how the organization should be run.

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In order to understand how Taylor's scientific management revolutionized industry and helped shape modern organization, one needs to understand what came before him. The industrial revolution had been underway for nearly 100 years before Taylor took his first job as an engineer at Philadelphia's Midvale Steel Company in the Fall of 1878 (Nelson, p. 29).

Most histories of the industrial revolution focus on technological developments, such as interchangeable parts, steam power, and the assembly line. Very little has been written about how nineteenth century plants were organized and managerial power was delegated. In virtually all industries, regardless of the types of manufacturing operations taking place, the foreman was, for all intents and purposes, the manufacturer (Nelson, p. 4).

The foreman had near absolute authority over the workers. He was responsible for hiring and firing personnel, training them, arbitrating grievances, promoting and demoting workers, and enforcing the manufacturer's personnel policies regarding work hours, personal appearance, and rules of conduct. In many industries the "piece work" system was common. The foreman set the wages using a "rule of thumb" method (Nelson, p. 8).

The manufacturer, for whom the foreman worked, usually watched the payroll very closely. When piece workers were so productive that they earned more than the prevailing day wage, the manufacturer would order the piece rate cut, removing any incentive to produce more. Combined with the difficult and unsafe work environments in many factories, there was a more or less permanent state of labor-management strife. Strikes and violence were common (Nelson p. 9).

Operating in such circumstances it is understandable why Taylor work so hard to promote his 'one best way' to lay the foundations of how businesses should be run from an organizational standpoint. Separating the workforce from management proved to be a recipe for success at the time. A job required a specific type of employee and at the same time, an employee was matched to a specific job that suited him. Management was left to improve other aspects of the business. Separating the workforce allowed businesses to operate more efficiently. The worker would concentrate on the day-to-day tasks asked of them, and not have to worry about the decision making. Decisions were left to management who were able to take the best course of action after careful study, planning, and implementation of pre-defined standards. "Taylor was helping to create the modern white-collar workforce." (Kanigel, p.351) He was able to create a system, founded on issues during his lifetime (production, order, efficiency, labor), that could transcend time and be beneficial to age, be it past, present, or future.

Managers were taught to look at every aspect of a manufacturing operation as a piece of an integrated system. Improvements made to one process would lead to improvements to a different process down the line. "The idea that every part of a factory or a whole organization should be scientifically analyzed and redesigned to achieve the most efficient output." (Wrege, p. 255) Managers could continue to use time study to improve and eliminate bottlenecks. Instead of leaving the workers alone to solve problems they might be confronted with, management would be able to determine the best course of action scientifically and then train the worker to perform the task accordingly.

Taylor's ideas were not limited to only serving the company's bottom line. The increase in productivity benefited the workforce as well. Workers were paid by "piece rate," a fixed wage for each unit produced or action performed. This generally failed because standards were poorly set, employers cut rates when workers earned "too much", and workers would conceal their real capacity for production to keep standards low. In order to rectify this, Taylor pushed for standards to be set for wages. A clearly defined wage should be established and be directly related to the complexity of the job. (mgmtguru.com)

This method of management led to an increase in a worker's output, allowing them to take home a greater pay than ever before. Under the system, incentives were offered for greater output. Even in modern times, this principle holds true for those that earn bonuses from commission. The increased output did not come at a physical cost to the worker as one might assume. For those not under scientific management's guidelines, increased output meant that the worker had to work harder and

work longer hours. Scientific management, however preach efficiency in order to increase output. Workers did not need to physically exhaust themselves. They needed to work smarter.

In summary, scientific management revolutionized industry because it explains how to increase production by working smarter, not harder. Up until that time, increasing output meant more hours, more employees, more raw materials, and more costs. Scientific management uses basic logic to show how standardization, productivity, and division of labor painted a picture of efficiency that resonates today. Not only does scientific management aid a company to accomplish its goals, but it improves the quality-of-life of the workforce, creating a win-win situation for all parties involved.

Standards & Benchmarking

Clearly, creating standards is at the core of why scientific management is a beneficial organizational model. Standards are universally accepted guidelines that help govern procedures and courses of action for given scenarios. In pre-Taylorism days, a common bottleneck that organizations face is "rule-of-thumb" or guess-work when it comes to dealing with issues, by not having a clear path to follow. Having a standard in place would eliminate this uncertainty and allow the wheels to continue moving forward. "The standard" should also be looked at as a benchmark, a level or point of reference from which measurements can be made. Measurements allow for an analysis of productivity. They are used to identify how efficiently employees, processes, and procedures met or exceed the standard.

"The system's base was research and experimentation to replace the old 'rule of thumb." (Wrege, p. 255) Research under scientific management is the collection of raw data. Research is one of the most crucial components of developing a standard. The raw data gathered can be measured. It's something tangible, something that can be accounted for.

Legacy of Taylorism

The impact of Taylor's work on the field of management has long been recognized by management scholars. Wren & Hay's (1977) study saw Taylor at the top of the list among contributors to American management thought and practice. Heames & Breland's (2010) study found Taylor to be at the top of their list thirty years later. The Principles of Scientific Management, not only tops Bedeian and Wren's (2001, p. 222) list of the 25 most influential management books of the 20th century, but they refer to it as "The most influential book on management ever published."

The legacy of scientific management is found wherever machine-like precision in an operation is required to improve profitability. In numerous work practices scientific management is present when workers assemble a McDonald's hamburger or when a technical support representative answers a call under pressure from a 90/10 protocol (Bell & Martin, 2012).

There is ample evidence that Taylor's work on efficiency has had an enormous impact on management education in the progressive era. Further, it can be argued that Taylorism also has tremendous implications for present-day managers which make the methods relevant in a modern management environment (Schachter, 2010). Taylor was among a very small number of scholars in his day to begin thinking about work and efficiency of time and motion in relation to productivity and the added value of this new-found productivity to organizational surpluses. Modern management owes a good deal to Taylor's work, since efficiency is a "cherished administrative value" in public administration too. Efficiency is a guiding value even for government leaders (Schachter, 2007).

The following are a list of modern management tools and terms that has its roots linked to scientific management:

Accounting Cost Control

Taylor introduced a cost accounting system at Bethlehem that focused on moving the function of accounting from a post-mortem system of annual, semi-annual, and monthly reports too late for management to be pro-active in taking action and making changes. He implemented a cost accounting system modeled after that being used at the Frankford Arsenal near Philadelphia. Taylor also succeeded in moving the cost accounting function to the planning department generating cost reports

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coincident with daily operations reports and in line with the philosophy of his fourth principle (Wren, 1972).

Organized Labor Relations

When Henry Ford added the assembly line in 1913 to the then narrowly defined jobs that were proposed by Frederick Taylor in his principles, the mass-manufacturing model was established for much of the rest of the century (Budd, 2005). There was some initial opposition to Taylor's principles. The labor movement initially opposed what they called "Taylorism", and strikes against time studies and incentive pay plans resulted. At some level this underlying conflict between organized labor and management continues to exist today (Budd, 2005).

Operations Process Control Management

The fact that Taylor introduced the concept of using scientific methods to measure and control the processes of work is a very important contribution to industrial management (Taylor, 1919; Hampton, 1994).

Operations Service Sector Management

Today, an airline in the likes of Southwest Airlines uses teamwork and rapid cleaning methods to wash windows for fast turnaround of its flights. This is an example that demonstrates some of the fundamental ideas on task assignments that Taylor introduced in his principles almost a century ago (Davis *et al.,* 2003).

Quality Management

Taylor introduced the use of mnemonic classification, leading to grouping of machines (group technology), and later renamed to cellular manufacturing where different parts requiring similar machines are produced. The economic benefits of group technology become significant when cost reductions in production control, materials handling, and inventory control are considered (Hampton, 1994). One could say that Taylor's scheme of classification and measurement created a building block necessary for the present day implementation of quality management.

Technology Management

"Changing an organization's technology involves altering its equipment, engineering processes, research techniques, or production methods. This approach goes back to the scientific management theory of Frederick W. Taylor" (Stoner *et al.,* 1995, p. 419).

Countries that Adopted Scientific Management

Frederick Taylor died of pneumonia in 1915; just five years after the publication of The Principles of Scientific Management brought him world-wide recognition. Scientific management soon became a machine of universal efficiency. The Principles of Scientific Management were translated into Chinese, Dutch, French, German, Italian, Russian, and Japanese (Kanigel, p. 22).

Ironically, one of the first countries outside of the US to make widespread use of scientific management was the newly formed Soviet Union. Lenin, who was familiar with Taylor's work, believed that in order to transform the USSR from the nearly feudalistic country that it was under the czars into a major industrial power, a mass educational effort was necessary. In fact, Vladimir Lenin believed that Taylor's methods could be used to manage the entire nation:

"We should immediately introduce piece work and try it out in practice. We should try out every scientific and progressive suggestion of the Taylor System…..The Soviet Republic must adopt valuable and scientific technical advances in this field. The possibility of socialism will be determined by our success in combining Soviet rule and the Soviet organization of management with latest progressive measures of capitalism. We must introduce in Russia the study and the teaching of the new Taylor System and its systematic trial and adaptation" (Wren p.1).

The Soviet Union's famous five-year plans that set goals for industrial productivity and economic growth were a direct result of scientific management principles (Wren p. 4).

As Taylorism was influencing the growth of the USSR during 1920's, Japanese industry also began adopting Taylor's techniques. One of the first disciples of scientific management in Japan was a man named Ueno Yoichi. In 1919, Ueno was hired by the Lion Toothpowder Company, where he increased the productivity of its packaging department by 20 percent while reducing the area of working space by 30 percent and cutting work time by one hour per day. Uneo became a leading proponent of scientific management in Japan, in the years leading up to the Second World War, many in Japanese industry embraced Taylorism (Tsutsui p. 446).

As scientific management became more popular in industry during the early part of the twentieth century, it began to influence other segments of society and culture, particularly in the progressive movement. For example, the famous conservationist Gilford Pinochot, who was appointed by President Theodore Roosevelt to head what is now known as the Department of the interior, saw his work as, "efficient management of natural resources." Progressive reformers, who were interested in reducing public corruption carefully, began to study things like the amount of money spent on constructing things like sewer lines verses the amount of people living in each square block. Home economists, many of them advocates of women's suffrage, did time and motion studies of house work in the hopes of relieving some of its drudgery, in the hopes that it would give women more time to educate themselves in order to become better participants in American democracy. A certain type of technical utopianism emerged (Schwartz-Cowan p. 212-213).

Scientific management has also spread beyond the scope of the workplace. Most armies around the world employ scientific management. In virtually every facet of armed forces, there is a standard method of performing each job. Enlisted men are drilled time and time again to complete specific tasks in a specific manner until they become routine. Those with appropriate abilities for a task are then made to perform only in that task. Essentially, the job is matched to the worker. Those with keen eyes become snipers or scouts and those with an understanding of strategy are promoted into "intelligence operations."

While workers in the US and in Europe resented Taylorism with its incentive wage schemes and work specialization and simplification that was not the case in Japan. Although some of the reasons for this are open to interpretation, many Japanese workers saw scientific management as elevating their status as "modern factory workers." Scientific management delivered on its promise of elevating wages, and some workers even saw it as an honor to be the subject of a time and motion study (Tsutsui, Manufacturing, p. 39).

Even with the use of scientific management techniques, there were important cultural differences between the Japanese approach to management and that of their American and European counterparts. Their management style was much more paternalistic, perhaps derived from the traditional Japanese feudal relationship between lord and retainer. There was a strong value among both managers and workers for harmony and cooperation (Tsutsui, Manufacturing p. 49).

Criticism and Limitations of Scientific Management

The critics of scientific management in the likes of Maqbool (2011) argue that Taylorism has given rise to massive production, economies of scale, and cost effectiveness but the narrow focus of job and more significance to technology had created mere machines and mechanical life where only materialism prevailed. It is also true that working environments was deplorable within the firms because of lack of imagination, inflexibility, and rigidity. Under Taylorism, bureaucracy flourished and created distance between employees due to separation of these two groups. Consequently, they were deprived of healthy feedback from each other. There was no place for innovation because of fixed rules set by management. Workers imagination was confined to work in boundaries. In essence, Taylorism has deteriorated human beings morally through extensive race, greed, materialism, status consciousness, tangible benefits and competition.

Despite the efficiency and effectiveness brought about by scientific methods there emerged a growing public backlash. In 1911, workers at the Watertown Arsenal in Massachusetts, where Taylor was employed, went on strike in support of a worker who refused to allow engineers to time what he was

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doing with a stopwatch. The incident received a great deal of newspaper coverage and led to Congressional hearings at which Frederick Taylor was called to testify.

Today, with the benefit of nearly 100 years of hindsight, many of the Taylorism's shortcomings are glaringly obvious. The "one size fits all" approach to motivation, the consuming focus on efficiency with a near total disregard for quality, and the deaf ear held by management to suggestions by subordinates seems very outdated by today's standards. But Taylor's scientific approach – the application of statistical techniques to production and efficiency, and his focus on what motivates workers, set the stage for what would come later.

CONCLUSION

Frederick Taylor was one of the first people to view management as a science to be studied. He was the first person to study motivational theory, and apply statistical techniques to manufacturing. At a time when labor was cheap, supplies were plentiful, and manufacturing processes were relatively forgiving of quality control issues, scientific management was a tremendous improvement over the old factory systems with its tyrannical foremen and rules of thumb. He revolutionized the way management approach businesses and organizations. His theories on using science and statistical fact have become a guideline that many have followed to great success. Is scientific management a perfect system? No. However, one cannot deny its contributions to society and measurement of efficiency.

REFERENCES

Bell, R.L. and Martin, S.L. (2012). The Relevance of Scientific Management and Equity Theory in Everyday Managerial Communication Situations. *Journal of Management Policy and Practice*, vol. 13(3)

Budd, J.W. (2005). *Labor Relations: Striking a Balance*. New York: McGraw-Hill/Irwin.

Copley, F.B. (1923). *Fredrick W. Taylor: Father of Scientific Management*. (Vols. 1-2). New York: Harper & Row.

Davis, M.M., Aquilano, N.J. and Chase, R. B. (2003). *Fundamentals of Operations Management*. New York: McGraw-Hill/Irwin.

Frederick Winslow Taylor: Father of Modern Management Frederick Winslow Taylor: Father of Modern Management, web article found at http://www.mgmtguru.com/mgt301/ 301_ Lecture1Page8.htm

Hampton, J.J. (Ed.). (1994). *AMA Management Handbook* (3rd ed.). New York: American Management Association

Heames, J.T. and Breland, J.W. (2010). Management Pioneer Contributors: 30-Year Review. *Journal of Management History*, 16(4): 427-436.

Kanigel, R. (1997) Taylor-Made, *The Sciences Volume* 37 Issue 3, May/June 1997

Kanigel, Robert. *The One Best Way*. New York: Viking.

McKenna, C.D. (2006). The World's Newest Profession—Management Consulting in the Twentieth Century, Cambridge, UK, Cambridge University Press

Maqbool, M., Zakariya, A. and Paracha, A.N. (2011). A Critique on Scientific Management, August, Vol 3, No 4, *Interdisciplinary Journal of Contemporary Research in Business*.

Nelson, D. (1980). Frederick W. Taylor and the Rise of Scientific Management Madison Wisconsin, University of Wisconsin Press

Nixon, F. (1962). Quality Achievements in Japan, The Statistician, Volume 12, Number 2

Schachter , H.L. (2007). Does Frederick Taylor's Ghost Still Haunt the Halls of Government? A Look at the Concept of Governmental Efficiency in Our Time. *Public Administration Review*, 67(5), 800-810.

Schachter, H.L. (2010). The Role Played by Frederick Taylor in the Rise of the Academic Management Fields. *Journal of Management History*, 16(4), 437-448.

Schwartz-Cowan, R. (1997). *A Social History of American Technology*. New York: Oxford University Press.

Stoner, J.A.F., Freeman, R. E. and Gilbert, D.A.J. (1995). *Management* (6th ed.). Englewood Cliffs, NJ: Prentice Hall.

Swiss Deming Institute comparison chart web page at http://www.deming.ch/E_index.htm

Taylor, Frederick W. The Principles of Scientific Management, Norton: New York, 1911.

Taylor, F.W. (1919). *Scientific Management.* New York: Harper & Row.

Tsutsui, W.M. (1998). *Manufacturing Ideology*: Scientific Management in Twentieth Century Japan, Princeton. New Jersey: Princeton University Press.

Tsutsui, W.M. (2001). The Way of Efficiency: Ueno Yoichi and Scientific Management in Twentieth Century Japan. *Modern Asian Studies*, Volume 35 Number 2

Wrege, Charles D., Frederick W. Taylor: *The Father of Scientific Management*, Irwin, 1991.

Wren, D. A. (1972). *The Evolution of Management Thought*. New York: The Ronald Press Company,

Wren, D.A. and Hay, R.D. (1977). Management Historians and Business Historians: Differing perceptions of pioneer contributions. *The Academy of Management Journal*, 20(3): 470-476

Wren, D.A. (1980). Scientific Management in the U.S.S.R., with Particular Reference to the Contribution of Walter N. Polakov, *Academy of Management Review*, Volume 5 Number 1, January, 1980.