

Some Remarks on the Emergence of Scientific Management

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Abstract:

The basic principles of "scientific management" was first formulated by F.W. Taylor in his well known book, "The Principles of Scientific Management" first published in 1911. Scientific management, which focuses on controlling labour process in modern enterprises, has been discussed from the last quarter of the nineteenth century onwards. Early discussions on the topic were particularly dealing with the practical problems. However, a new wave of discussions emerged in the 1970s as a response to economic crisis of that period and as an attempt to reorganise business life. Thus, "scientific management" was examined in detail to build up more flexible management system -i.e. mean production - on the same basis. But, in my opinion, in both discussions, "scientific management" was not examined with its historical foundations. Instead, the development of scientific management was attributed to genius and extraordinary personality of its founder. Albeit there is no doubt about his genius, historical matters must be examined by using historical methods. In this respect, the central argument asserted here is that, the "scientific management" was a response to general crisis of 1873-1896 which was defined as "the Great Depression" by some authors. This crisis manifested itself with a persisting profitability problem arising from secular downward trend in prices and pessimistic investment conditions. In the competitive business environment of that period, the only measure to overcome this problem could be to increase the productivity of labour. Thus, this effort led to a careful study of the worker as an animate machine through the eyes of a new kind of engineer. In brief, my aim is to investigate the emergence of "scientific management" in its relation to the economic crisis as well as other structural changes that brought or accelerated by the crisis.

Keywords: Taylorism, nineteenth century, industrialisation, labour organisation, scientific management, great depression.

Introduction

In this paper, my aim is to explore the neglected historical dimensions of "scientific management". The term scientific management is used to specify a body of theory and practice directed toward more rational and efficient performance in industry. While it was originally used with reference to direct efforts to increase the productivity of labour, the application of the term has since been extended to include the basic factors in the process of production as a whole (Person, 1934, p.603). Moreover, during the twentieth century, scientific management penetrated public sphere as well.

Scientific approach to management was systematically developed by an American mechanical engineer F.W. Taylor. However the attempts to develop management function on a scientific basis preceded Taylor's studies. Especially during the period following the industrial revolution, the

factory system emerged and the development of this system brought with itself many new problems related with the organisation and management of labour, the structure and equipment of factories and the technique of production (Thompson, 1914, p.506). These problems associated with the production process solved in a way to make manufacturing at a profit possible. But as I argue in this paper, early solutions were inevitably rudimentary and insufficient.

In the first part of this study, early history of management practices will be argued. The second part focuses on the role of 1873-1896 economic crisis in the emergence of scientific management. The third part explains the main arguments of Taylor in the context of scientific management. The final part covers the concluding remarks.

I. The Early History of Labour Organisation

The classical economists were the first thinkers who mentioned the problems of the organisation of labour in the modern sense. Sir William Petty and Adam Smith (1937) wrote about the division of labour in production process and its crucial role for productivity.¹ But, management as a field of study appeared alongside with the industrial capitalism which in turn emerged from the occurrence of industrial revolution.

According to conventional approach industrial capitalism began in the last quarter of the eighteenth century when significant number of workers started to be employed by a single businessman within a factory (Ashton, 1968). As soon as the producers were gathered together, the problem of management arose in embryonic form. But attempts towards to organise labour goes back to earlier times. The Pyramids, the Great Wall of China, extensive networks of roads, aqueducts and irrigation canals, monuments, cathedrals, etc., dating from antiquity and medieval times required too many workers in their construction processes. Apart from these huge projects there were workshops which produced weapons for the armies of the traditional Empires. In these workshops, there was elementary division of labour which can be considered as embryonic forms of later modern production process. As Braverman (1974, p.64) pointed out; "Roman workshops for metalwork, pottery, leather, glassblowing, brickmaking, and textiles, as well as large agriculture estates, brought together scores of workers under a single management". Nevertheless, these early practices were carried out by dependent labour, either slaves or serfs and because of the absence of market-motive, technology was stagnant. For instance, The Pyramids were constructed with the surplus labour of an enslaved population for the greater glory of the pharaohs in this world and the otherworld. Roads, aqueducts, and canals were built for their military or civilian usefulness and not generally for a profit-motive.

Another instance might be given from the seventeenth century France. Here, state-subsidised manufactories created by the famous governor Colbert, had benefited from being actual or legal monopolies. These manufactories were producing arms or luxury goods and receiving very large orders from court or army (Kemp, 1971, p.33).

The management required under such circumstances remained elementary and this was particularly true when the labour was that of slaves and sometimes supervised by slaves as well. The modern businessmen, however, working with waged labour and profit motive must consider production costs and renew technology to survive in a competitive environment. In

¹ For Petty's contributions to this issue, see Hutchison (1988, p.39-40).

this context, modern entrepreneur must implement the most effective management techniques.

In order to understand the conditions that pave the way for modern management, which was established in the late 19th century, it is required to mention early history of industrialisation. It is true that industrialisation emerged with industrial revolution. But there was an early history dating nearly back to three centuries before this event. This transitional period from feudalism to industrial capitalism is named by historians under various headings. Among them, "commercial capitalism", "mercantilism", "agrarian capitalism" or "the age of manufacture" could be mentioned. During this period, feudal social relations gradually declined. Western Europe witnessed the dissolution of manorial economy of feudal order and emergence of domestic and manufactural economy from the fifteenth century onwards.

In the manufactural phase, traditional craftsmen like spinners, weavers, glaziers, potters, blacksmiths, millers and bakers, etc. were being employed by merchant-capitalists. These craftsmen were embodied traditional knowledge and skills of their crafts. This early form of industry was simply gathering of small units of production and reflecting little change in traditional methods and thus, the work remained under the immediate control of producers.² Here the functions of management were brought into being by the very practice of co-operative labour. Even an assemblage of independently practising artisans requires coordination, if one considers the need for the provision of a workplace and the ordering the process within it, the centralisation of the supply of materials even the most elementary scheduling of urgencies and tasks, and the maintenance of records of costs, payrolls, materials, finished goods, sales, credit and the calculation of profit and loss (Braverman, 1974, p.59-60). Another assembly works like shipbuilding and coachmaking required relatively advanced cooperation of different kinds of labour. Again some industries which had little handicraft background -i.e. sugar refining soap boiling, distilling- and various primary process like iron smelting copper and brass working were completely transformed. All of these required conceptual and coordination functions which took the form of management in the industry.

There were more immediate precedents for the early industrial capitalist to draw upon, in the form of mercantile enterprises, plantations, and agricultural estates. Merchant capitalism invented checks and controls; and from commercial capital the industrial capitalist also took over the structure of branch organisation subdivided among responsible managers. Agricultural estates and colonial plantations offered the experience of a well-developed supervisory routine, particularly since much early mining (and the construction works that relied on it) was carried out on the agricultural estates of Great Britain under the supervision of estate agents (Braverman, 1974, p.65).

Before industrial revolution, regulation of feudal guilds and apprentice rules and the other restraints common to feudalism, albeit declining, were still determining social and economic relations. To avoid these pre-capitalistic obstacles, businessmen tended to escape new towns and some rural areas which were free of guilds and feudal regulations and traditions.

The early phases of industrial capitalism were characterised by entrepreneur's attempt to obtain producer's products without taking into account the labour market. Instead they preferred great variety of sub-

² For detailed discussion of this process, see Dobb (1964).

contracting and putting-out systems. In the form of domestic labour it was to be found in textile, clothing, metal goods, watch making, hat, wood and leather industries where the merchant capitalist provided material on a piecework basis to workers for manufacture in their own homes through the medium of sub-contractors and commission agents. But even in industries where work could not be performed at home such as coal, tin and copper mines, mine workers themselves working at the face, took contracts individually or in gangs, either directly or through the mediation of subcontracting employer. This system persisted even in early stages of factory system. In cotton mills skilled spinners were put in charge of machinery and usually engaged child assistants from among their own families and acquaintances. Foremen sometimes added to their direct supervisory function the practice of taking few machines on their own account and hiring labour to operate them (Braverman, 1974, p.61).

In the United States the contract system in which puddlers and other skilled iron and steel craftsmen were paid by the ton on a sliding scale pegged to market price. Hiring the workers by skilled labourers was distinguishing characteristic of this industry until almost the end of the nineteenth century. Dobb (1964, p,266) depicts the picture as follows;

As late as 1870 the immediate employer of many workers was not the large capitalist but the intermediate sub-contractor who was both an employee and in turn a small employer of labour. In fact the skilled labour of the middle nineteenth century tended to be in some measure a sub-contractor and in psychology and outlook bore the marks of his status.

Moreover this type of relationship prevailed not only in trades still at the stage of outwork and domestic production such as gunmaking, coachbuilding but also in sectors that factory system dominated. In brief, in early stage of industrial capitalism businessmen utilises labour as it comes to them from prior forms of production while implementing conventional labour process. In other words, the workers are already trained traditional arts of industry previously practiced in feudal and guild handicraft production. And these skilled workers were controlling the speed and course of production process. Under these conditions, main task of the early management unit was just to realise a control mechanism on workers. Control without centralisation of employment was, if not impossible, certainly very difficult, and so the precondition for management was the gathering of workers under the single roof. The first effect of such a change was to enforce upon the workers regular hours of work, in contrast to the self-imposed pace which included many interruptions, short days and holidays, and in general prevented a prolongation of the working day for the purpose of producing a surplus under then-existing technical conditions.³

In all these early efforts, the businessmen were groping toward a theory and practice of management. Having created new social relations of production, and having begun to transform the mode of production, they found themselves confronted by problems of management which were different not only in scope but also in content from those characteristic of earlier production processes. Under the special and new relations of modern capitalism, which presupposed a "free labour contract" businessmen had to extract from their interests, to impose their will upon their workers while operating a labour process on a voluntary contractual basis. Taylor's all effort was devoted to solve "labour problem" under these new conditions. In Nelson's (1974, p.480) words; "rather than a

³ For detailed information, see Pollard (1965).

'partial solution of the labour problem,' the Taylor system was a comprehensive answer to the problems of factory coordination, a refinement and extension of systematic management". In the following part, the environment which motivated his efforts will be investigated.

II. "The Great Depression" of 1873-1896 and Scientific Management

As it was mentioned above, scientific management is an outcome of industrial revolution and its by-product factory system. However, the comprehensive formulation of management theory appeared in the late nineteenth and early twentieth centuries. This period differentiated itself from the first half of the nineteenth century in terms of enormous growth in the size of enterprises, monopolistic tendencies in the organisation of industry and purposive and systematic application of science to industry. According to Braverman (1974, p.85), the scientific management movement initiated by F.W. Taylor in the last decades of nineteenth century was brought into being by these forces. And he also warns us with the following words; "...Taylorism belongs to chain of development of management methods and organisation of labour and not to the development of technology in which its role was minor."⁴

Scientific management can be defined as an attempt to apply the methods of science to the increasingly complicated problems of control of labour in rapidly growing enterprises.

A comprehensive and detailed outline of the principles of Taylorism is out of this investigation. Nevertheless, to clarify the issue, main arguments of Taylor together with the contemporaneous conjuncture should be mentioned. Besides, the intellectual sources, which he was directly influenced, must be considered as well. At this point, I am underlining the role of 1873-1896 crisis, which is called as the "Great Depression". In this context, the emphasis will be given to explain the main features and the role of this crisis in the emergence of scientific management.

The years from 1873 to 1896 seemed to many contemporaries a startling departure from historical experience. There are two main issues to consider about the period named the "Great Depression" (before the 1930's). First to explore what was happening in the economy, and then, to find out mechanisms to overcome problems revealed by crisis.⁵

Obviously, the period was not simply a depression according to the usual meaning of the word. During the period prices fell unevenly, irregularly but inexorably through crisis and boom-an average of one third of all commodities. According to many interpreters including contemporaries, "it was most drastic deflation in the memory of man". And the rate of interest declined to the point where the capital was so abundant as to be almost a free good (Landes, 1969, p.231).

In a competitive environment, deflation meant a pressure on the rate of profit. In D. Landes's (1969, p.231) words; "...profits shrank while what was now recognised as periodic depressions seemed to drag on interminably. The economic system appeared to be running down".

⁴ Taylor (1947, p. 40,77)'s examples to explain how the scientific methods work in management process support this argument. In *"The Principles of Scientific Management"* he illustrated scientific management with trades which are based on the most elementary form of labour such as pig iron handling and bricklaying.

⁵ The review of the explanations put forward by various authors to explain the causes of the depression is out of the scope of this investigation. For this issue, see Rostow (1948).

During the same period under consideration, while England experienced a prolonged depression, the United States and Germany could achieve their industrialisation on the basis of new industries such as heavy engineering, chemicals and steel. However the economic conditions that prevailed were universal. The producers of Germany and the United States were also suffering from depression in trade. An American observer of this era, D.A. Wells (1889, p.1-5) was underlining the universality of crisis and narrated financial and mercantile bankruptcies in the U.S. for the post 1873 period.

A.J. Wilson, an author of this period, in his *Resources of Modern Countries* (1878) was writing in a much more pessimistic way;

Everywhere there is stagnation a negation of hope. The low present Condition of business enterprise and possibilities at present nearly universal...Month by month English exports have been declining and month by month producers are content to take lower prices.

...On all grounds I look for a further depression in the trade of this country, and when I consider how unprepared we are by our habits and social conditions for a prolonged time of retrogression. I confess the prospect is to mean alarming one...This is not a period like those which followed ordinary panics. It is, more likely, the beginning of a new era for ourselves and the world (quoted by Beales, 1934, p.68-69).

M.Dobb (1964, p.300) brightly pointed out that "(the Great Depression) has come to be regarded as forming a watershed between two stages of capitalism; the earlier vigorous prosperous and flushed with adventurous optimism; the later more troubled, more hesitant and, some would say, already bearing the marks of senility and decay".

Despite the above comments stressing the pervasive conditions of depression, some authors objected to depression argument for this period. Among them, S.B. Saul (1969), evaluated the depression argument as "a myth" by looking at various economic indicators. Indeed, when we consider growth rate of total output and volume of foreign trade for industrialised country, a positive trend -even decreased relatively - could be seen. Therefore, Beales (1934, p.68) asked the following crucial question;

If it be feasible, on the ground of falling prices, to regard the years from 1873-1896 as a unity, is it reasonable to describe them as "the great depression?"

However, the businessmen, officials, politicians and economists were discoursing about depression. Even "The Royal Commission for Depression on Trade", which was established to investigate the causes of depression, accepted that "they had no secret incantation, no 'open sesame' which broke the evil spell of depression" (Beales, 1934, p.68). Alfred Marshall (1926, p.99) one of the most influential economist of that era, was summarising the situation as follows; "A depression of prices a depression of interest and a depression of profits. I can not see any reason for believing that there is any considerable depression in any other respect."

Nevertheless, it is certain that there was a pessimistic business environment in that period. Because of the falling prices, investments were not profitable. Under this circumstance, the initial reaction to

depression was to eliminate competition. This tendency was stronger in the United States and Germany rather than the United Kingdom. In these countries, in addition to mergers and acquisitions, monopolies such as trusts and cartels were created almost in all sectors of the economy. In the United Kingdom, "the workshop of the world", this tendency was weak due to the fact that this country had already a monopoly power in world manufacture, trade and shipping. Therefore she insisted on the free trade doctrine. Monopolisation as a measure to oppose depression accelerated the inherent tendency towards growing for the firms. In these big enterprises, systematic management became both possible and necessary (Hobsbawm, 1987, p.40-45).

Another measure implemented in this period was increasing productivity by developing more efficient management techniques. Henceforth Taylor and his contemporaries devoted their effort to accomplish this aim, played a crucial role.

Taylor started to work as an apprentice after one year following the panic of 1873. He referred this crisis in his *Principles of Scientific Management* as follows;

The writer came into the machine-shop of the Midvale Steel Company in 1878, after having served an apprenticeship as a pattern-maker and as a machinist. This was close to the end of the long period of depression following the panic of 1873, and business was so poor that it was impossible for many mechanics to get work at their trades. For this reason he was obliged to start as a day labourer instead of working as a mechanic. Fortunately for him, soon after he came into the shop the clerk of the shop was found stealing. There was no one else available, and so, having more education than the other labourers (since he had been prepared for college) he was given the position of clerk. Shortly after this he was given work as a machinist in running one of the lathes, and, as he turned out rather more work than other machinists were doing on similar lathes, after several months was made gangboss over the lathes (Taylor, 1947, p.48).

Depression conditions in steel and pig-iron sector were fairly evident. Under these conditions, usual behaviour of businessmen, if enterprise did not fail, is to keep production by implementing measures towards raising productivity and lowering costs. For Taylor, this was an opportunity to realise his experiment focusing on time and motion studies. In the following part the principles of scientific management will be argued.

III. The Main Principles of Scientific Management

The main purpose of "the scientific management" is to increase the productivity. This aim was pursued by three major methods; i) by isolating each worker from work group and transferring the control of the work process from workers to the agents of management who told the worker exactly what to do and how much output to produce in the light of ii) a systematic breakdown of each process into timed component elements. (time and motion study) and iii) different systems of wage payment which would give the worker an incentive to produce more (Hobsbawm, 1987, p.44).

The use of the experimental methods in the study of work did not begin with Taylor; in fact, the self-use of such methods by the craftsman is part of the very practice of a craft. Being a follower of classical economists that mentioned above, Charles Babbage who might be considered

as the most direct predecessor of Taylor, in his *The Economy of Machinery and Manufactures* (1832), wrote about the crucial points of the organisation of labour process in his day. Meanwhile, the French tradition in management or scientific study of work must have influenced Taylor. French tradition starts with Colbert, the famous minister of Louis XIV and includes military engineers like Vauban and Belidor, and culminates in Henri Fayol, a contemporary of Taylor who in his "General and Industrial Management" attempted a set of principles aimed at securing total enterprise control by way of a systematic approach to administration.

Taylor was basically interested in production process. He dealt with the organisation of labour process and control over it. Namely, he has little in common with physiologists who have attempted to gather information about human capacities to contribute management science.

One of the most distinctive aspects of Taylor's thought was his concept of control. Control has been the essential feature of management throughout the history but with Taylor it assumed unprecedented dimensions. The stages of management control over labour before Taylor had included progressively; the gathering together of the workers in a workshop and the dictation of the length of the working day; the supervision of workers to ensure diligent, intense, or uninterrupted application; the enforcement of rules against distractions (talking, smoking etc.) that were thought to interfere with application; the setting of production minimum etc. A worker is under management control when subjected to these rules. But Taylor raised the concept of control to an entirely new plane. That management had the right to control labour was generally assumed before Taylor, but in practice this right usually meant only the general setting of tasks with little interference in the workers mode of performing them. Taylor's contribution was to overturn this practice and replace it by its opposite. Management, he insisted, could only be a limited and frustrated undertaking so long as it left to the worker any decision about the work. His system was simply a means for management to achieve control of the actual mode of performance of every labour activity, from the simplest to most complicated. To this end he pioneered a far greater revolution in the division of labour than any that had gone before (Braverman, 1974, p.90-91).

Taylor was born in 1856 to a wealthy and renowned Quaker family in Philadelphia, Pennsylvania, USA. He wanted to attend Harvard University, prepared for college at Philips Academy in Exeter. At Exeter he was influenced by the classification system invented by Melvil Dewey in 1872 (Dewey Decimal System). Then, he was accepted at Harvard, but poor eyesight forced him to consider an alternative career. Probably, young Taylor changed his career plan to oppose his father who had been trying to direct him toward his own profession, the law. Somehow, in 1874, -one year after the panic of 1873- he then took the step extraordinary for anyone of his class, of starting a craft apprenticeship in a firm whose owners were social acquaintances of his family. When he completed this apprenticeship, he took a job at common labour in the Midvale Steel Work, also owned by friends of his family and technologically one of the most advanced companies in the steel industry. Within a few months, he had passed through jobs as clerk and journeyman machinist, and was appointed gang boss in charge of the lathe department. He became in 1878 a machine shop labourer at Midvale Steel Company. He introduced time-motion studies in 1881 with ideas of Frank B. and Lillian M. Gilbreth. In 1883 he earned a degree by night study from Stevens Institute of Technology. He became general manager of Manufacturing Investment Company in 1890, and then a

consulting engineer to management.⁶ But, although the groundwork of Taylor's philosophy had been laid several years earlier it was not until 1911 -when he published his "Principles of Scientific Management"- that it began to receive widespread publicity (Bedeian, 1988, p.492).

Taylor believed that the industrial management of his day was amateurish, that management could be formulated as an academic discipline, and that the best results would come from the partnership between a trained and qualified management and a cooperative and innovative workforce. Each side needed the other, and there was no need for trade unions. For him, scientific management;

...does not necessarily involve any great invention, nor the discovery of new or startling facts. It does, however, involve a certain combination of elements which have not existed in the past, namely, old knowledge so collected, analyzed, grouped and classified into laws and rules that it constitutes a science; accompanied by a complete change in the mental attitude of the working men as well as of those on the side of the management, toward each other, and toward their respective duties and responsibilities. Also, a new division of the duties between the two sides and intimate, friendly cooperation to an extent that is impossible under the philosophy of the old management (Taylor, 1947, p.139).

Taylor created a simple line of reasoning and advanced it with a logic and clarity. His work began in the 1880s but he started to lecture, read papers and publish results in 1890s. His own engineering training was limited but his grasp of shop practice was superior since he had served a four year combination apprenticeship in two trades, those of patternmaker and machinist. The spread of Taylor approach was not limited to the U.S. and the U.K; within a short time it became popular in all industrial countries. His approach took the name in Germany rationalization while it was calling in France as "L'organisation rationelle du travail" (Braverman, 1974, p.89).

Shortly after Taylor became gang boss, he entered upon a struggle with the machinist under him. Because this struggle was a classic instance of the manner in which the antagonistic relations of production express themselves in workplace. According to him, main problem in the factories are soldiering and slow working. Three causes for this problem may be briefly summarized as;

First. The fallacy, which has from time immemorial been almost universal among workmen, that a material increase in the output of each man or each machine in the trade would result in the end in throwing a large number of men out of work.

Second. The defective systems of management which are in common use, and which make it necessary for each workman to soldier, or work slowly, in order that he may protect his own best interests.

Third. The inefficient rule-of-thumb methods, which are still almost universal in all trades, and in practising which our workmen waste a large part of their effort (Taylor, 1947, p.15).

For Taylor (1947, p.15) as long as the elimination of "soldiering" and of the various reason of slow working would so lower the production cost

⁶ For voluminous information about Taylor's life and works, see the works of Taylor's official biographer Copley (1993a and 1993b). Besides, see Nelson (1980) and Wrege and Greenwood (1991).

that domestic and foreign markets would be greatly expanded. Besides, competitive power of the U.S. would be increased against rival countries.

According to Taylor, as mentioned above, the basic principle of scientific management is transferring the control of the labour process from workers to the agents of management who told the worker exactly what to do and how much output to achieve in detail. "Under the old approach to management" says Taylor (1947, p.35), "success depends almost entirely upon getting the "initiative" of the workmen, and it is indeed a rare case in which this initiative is really attained." However, under scientific management or task management;

..."the "initiative" of the workmen (that is, their hard work, their good-will, and their ingenuity) is obtained with absolute uniformity and to a greater extent than is possible under the old system; and in addition to this improvement on the part of the men, the managers assume new burdens, new duties, and responsibilities never dreamed of in the past. The managers assume, for instance, the burden of gathering together all of the traditional knowledge which in the past has been possessed by the workmen and then of classifying, tabulating, and reducing this knowledge to rules, laws, and formula which are immensely helpful to the workmen in doing their daily work. In addition to developing a science in this way, the management take on three other types of duties which involve new and heavy burdens for themselves (Taylor, 1947, p.36).

Taylor classifies these new tasks under four headings;

First. They develop a science for each element of a man's work, which replaces the old rule-of-thumb method.

Second. They scientifically select and then train, teach, and develop the workman, whereas in the past he chose his own work and trained himself as best he could.

Third. They heartily cooperate with the men so as to insure all of the work being done in accordance with the principles of the science which has been developed.

Fourth. There is an almost equal division of the work and the responsibility between the management and the workmen. The management take over all work for which they are better fitted than the workmen, while in the past almost all of the work and the greater part of the responsibility were thrown upon the men. It is this combination of the initiative of the workmen, coupled with the new types of work done by the management, that makes scientific management so much more efficient than the old plan. (Taylor, 1947, p.36-37).

Taylor explains the fourth heading above as follows;

The philosophy of the management of "initiative and incentive" makes it necessary for each workman to bear almost the entire responsibility for the general plan as well as for each detail of his work, and in many cases for his implements as well. In addition to this he must do all of the actual physical labour. The development of a science, on the other hand, involves the establishment of many rules, laws, and formulæ which replace the judgment of the individual workman and which can be effectively used only after having been systematically recorded, indexed, etc.

The practical use of scientific data also calls for a room in which to keep the books, records, etc., and a desk for the planner to work at. Thus all of the planning which under the old system was done by the workman, as a result of his personal experience, must of necessity under the new system be done by the management in accordance with the laws of the science; because even if the workman was well suited to the development and use of scientific data, it would be physically impossible for him to work at his machine and at a desk at the same time. It is also clear that in most cases one type of man is needed to plan ahead and an entirely different type to execute the work. The man in the planning room, whose speciality under scientific management is planning ahead, invariably finds that the work can be done better and more economically by a subdivision of the labour; each act of each mechanic, for example, should be preceded by various preparatory acts done by other men. And all of this involves, as we have said, "an almost equal division of the responsibility and the work between the management and the workman."

To summarize: Under the management of "initiative and incentive" practically the whole problem is "up to the workman," while under scientific management fully one-half of the problem is "up to the management." (Taylor, 1947, p.37-38).

These long quotations from Taylor's *magnum opus*, are well explaining the scope and the aim of the scientific management. As I emphasised above, his main concern is to build up control over the workers by eliminating workers' initiative in production process.

Taylor's this approach to management was sharply criticised in two points. First point is related to human dimensions of the scientific management. According to this argument, in spite of the success of Taylor's managerial approach in increasing productivity, it is blind to human dimension. Taylor's scientific methods dehumanised the work process and regarded workers as an animated machine. The second argument underlines similar "blind spot". That is the "divorce of planning from doing" (Wrege and Greenwood, 1991, p.257).

The latter point discussed in 1970s to overcome bottlenecks of traditional scientific management. But this issue can be the subject of a different study.

Concluding Remarks

Taylor attempted to respond his own age's problems. Then, he formulated the principles that will be used during the twentieth century not only in business but also in spheres like bureaucracy, military and education. Therefore, scientific management concerns us with its all dimensions. As it is indicated in this paper, the historical approach helps us to deepen our insight. When a topic examined with all dimensions and within the historical context, the meaning of new questions arisen from historical experience can be understood properly.

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