

Alfred Marshall's critical analysis of scientific management*

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The value of a machine to a business can be calculated on the basis of its efficiency for its immediate work. But the value of an employee must be estimated (...) with a view to the probable development of his capacities: and the difficulty of this task is increased by the conditions of modern business.

(Marshall 1919: 350)

The dependence of industrial leadership on individuality and creative faculty has not been greatly effected by the predominance of routine in staple manufacture.

(Marshall Library Archive, Red Box 1)

1. Introduction

In 1911, in America, F.W. Taylor published his famous book, *Principles of Scientific Management*, in which new principles of industrial organization are suggested and the advantages of an extreme division of labour and mechanization are stressed.

Taylor's theory of scientific management played a very important role in shaping the early twentieth century factory system, both in America and in

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Europe. It produced an efficiency 'mode', which spread throughout Europe before the First World War.

In England, in 1919, Alfred Marshall published *Industry and Trade*, 'A study of industrial technique and business organization; and of their influences on the conditions of various classes and nations'. In his book, he develops a detailed analysis of scientific management, underlining its unquestionable advantages but also its dangerous limits.

In a recent article on Marshall and Scientific Management, John Whitaker notes that Marshall's 'evaluation of Taylorism was cautiously approving, if somewhat sceptical and he saw the movement as having the potential to both alleviate and heighten looming problems imperilling Britain's economy and British society in the post-war era' (Whitaker 1999: 255). Marshall's evaluation seems, indeed, more than sceptical and definitively critical in many passages of *Industry and Trade*.

The aim of this paper is to follow Marshall's analysis of scientific management in order to inquire into his attitude towards Taylor's system and to explain why the author's opinion is different from Whitaker's.

The structure of the paper is as follows: section 2 gives a sketch of the atmosphere in which scientific management was born and of how it was received at the time in the USA and Great Britain; section 3 provides an outline of Marshall's handling of scientific management and underlines the aspects that are the subject of his main criticism; section 4 highlights the grounds of his criticism; finally, section 5 draws some conclusive remarks.

2. The impact of scientific management: a brief comparison between the United States of America and Great Britain

2.1. Taylor and the American approval

In the 1890s American industry and economy entered the stage that characterizes a modern industrial country: the massive expansion of railroad, steamship, telegraph and newspapers favour the formation of an integrated national economy; power largely facilitates production processes in manufacture; plants and workshops grow significantly and the first important and potent trusts are created.¹ Another peculiar aspect of the American economy of the time was the massive availability of labour: millions of immigrants, coming especially from Europe, entered the

1 'The increased importance of large plants, and particularly of large aggregations of capital, was one of the outstanding features of the period' (Commons 1966: 293).

country in the twenty years before the First World War and influence the growing size of industrial plants.

Even though modern plants, with their size and technology, are very different from the traditional handicraft workshops, they still use traditional organization methods: 'internal management [has] (...) not improved *pari passu* with the growth of the industrial unit' (Commons 1966: 303). This problem is first discussed by the American Society of Mechanical Engineers, of which F.W. Taylor is a member.

Taylor, engineer and manager,² publishes important works on what he thinks should become organization and management in modern enterprises. The chief problem in applying traditional organization to modern plants is related to the labour side of businesses. Each foreman is still the supreme authority over all the processes and men, the organization is hierarchic and organized on a military model. But with an extremely large size of plant this kind of organization turns out to be quite inefficient: all orders have to go from the (top) manager down to superintendents and foremen and through them to the workmen. Taylor proposes a 'functional' scheme in order to improve plant management: the traditional work of foremen is divided into eight different functions:

Each workman, instead of coming in direct contact with the management at one point only, namely, through the gang boss, receives his daily orders and help directly from eight different bosses, each of whom performs his own particular function.

(Taylor 1903: 99)

According to Taylor, another reason for inefficiency in traditional organized businesses is the way individual tasks are performed: he proposes an accurate time study to discover the 'one best way' of executing each motion and to distinguish the best conditions, machines, tools and so on.

The first article published by Taylor is: 'A Piece Rate System, Being a Step Toward the Partial Solution of the Labour Problem' (1896), followed by 'On the Art of Cutting Metals' (1907). Taylor's main work, however, is *Principles of Scientific Management* (1911), a book translated into Chinese, Dutch, French, German, Italian, Japanese, Russian, Swedish and Spanish before the First World War.

The essence of Taylor system is minute division of labour, repetition of simple movement, predetermined methods of work, minimum training requested, incentive of a merely monetary nature and time optimization for each operation.³ The new system should produce high wages, high profits and, consequently, harmony between employers and employees.

² See Nelson (1992).

³ For further details, see Kendall (1913).

The debate on scientific management becomes very animated in America after the Eastern Rate Case (1910–11).⁴ Scientific management meets with widespread support, but also has fierce opponents. Among the supporters one finds, obviously, Taylor's collaborators or those who took inspiration from his work, such as Henry L. Gantt, Morris L. Cooke, Samuel Emerson and Lilian and Frank Gilbreth. But there are also a number of politicians⁵ and economists who warmly welcome the new system of organization. An economist who enthuses about Taylor's principles is Thorstein Veblen. In dealing with the development and functioning of firms (Rutherford 2003), Veblen greatly appreciates the suggested scientific organization of labour and workshops, since it looks capable of increasing technical and general efficiency.⁶ In 1913, Amasa Walker, another economist, suggests the application of scientific management, not only to productive processes but also to commercial activities of business:

in the belief that goods made under scientific management can and should be sold by scientific management, I venture to offer my views on the subject, fully realizing that mine may be a lone cry, but in the hope that whatever truth there is in the appeal, if any, may survive.

(Walker 1913: 388–9)

John Maurice Clark considers scientific management as a natural outlet of the progress of science since, he notes: '[s]cience is continually increasing the amount of standardization and scientific management in an attempt to introduce it in place of the more elusive craftsmanship and rule of thumb' (Clark 1918: 147). Irving Fisher goes even further in appraising Taylor's worth:

Frederick W. Taylor has made a unique place for himself in history as one who bridged the gap between science and industry, between theory and practice. The world owes him at least undying fame for his accomplishment in replacing guesswork by science and thereby adding immensely to the wealth and welfare of all mankind. Some day even labor may canonize him as a patron saint.

(Fisher 1925: 61)

4 In 1910, the railroads of the eastern part of the United States asked the Interstate Commerce Commission for an increase in freight rates, since they claimed their costs were enormously raised. On that occasion Louis Brandeis publicly opposed and proposed scientific management principles, through which it would be possible to diminish costs without increasing prices. For further details, see Dunn (1915).

5 See Nelson (1998, 1999).

6 On this topic, see Knoedler (1997).

The same level of enthusiasm is not shared by the institutionalist John Commons, who, on the contrary, emphasizes the dangerous and problematic aspects connected with the new system. Although he is not in opposition to any essential element of Taylor's ideas, he thinks that the new system, due to the extreme standardization of processes, would increase the conflicts between employees and employers.⁷ Moreover, according to Commons, the more important question is this: 'can scientific management deal scientifically with organizations as well as individuals?' (Commons 1911: 464).

Labour relations are of no concern in the individualistic point of view of engineers, but, definitely, they have a fundamental role in industrial systems. This is well known and deeply explored by Robert Hoxie. He is particularly interested in comprehending the reasons why 'organized labor' opposes scientific management (Hoxie 1916a) and in which measure scientific management participates in 'labor welfare' (Hoxie 1916b). Hoxie points out 'time and motion study' as the essence of scientific management and recognizes in its extension the most serious menace to the workers.⁸

The defects of scientific management are not hidden but are generally considered transitory. In Great Britain, scientific management was received in a very different way.

2.2. Technical or social considerations? Scientific management in Britain

By 1914 in Great Britain, numerous engineers were already familiar with scientific management 'by either reading about the new system (...), or by visiting American workshops firsthand' (Kreis 1990: 41). In the years between the 1890s and the 1900s, in fact, the debate on the changeover of British workshops is very strong and a very large number of articles on scientific management, efficiency and workshop methods are published.⁹

⁷ See Frey (1913).

⁸ 'The scientific management based upon it [time and motion study] is conceived to be a perpetual attempt to discover and put into operation the new and continuously developing technical, organic, and human arrangements, methods, and relationships constantly revealed by it to be more efficient and more equitable. That this broader conception of time and motion study as the essential basis of scientific managements exists, not as a mere dream, but as a practical ideal striven for with the confident hope of realization, the writer can attest from his experiences in the best class of scientific management shops' (Hoxie 1916b: 842–3).

⁹ See Whitston (1997).

These articles appear mainly in technical magazines such as *Engineering*, *The Electrical Review*, *The Engineer*, *Engineering Production*, *Cassiers Magazine* and *Engineering and Industrial Management* but also in less specialized journals such as *The Spectator*, *Round Table*, *Nature* and *The Economic Journal*.

Scientific management receives a fair deal of attention and many positive comments: the articles in *Cassiers*, for instance, are enthusiastic, while *Machinery* calls scientific management ‘the application of common sense’. The only magazine completely hostile to Taylor’s system is the *Engineer*, which, in 1911, declared that the new system is unfair and inhuman. The aspect most often criticized is the extreme division of labour and the necessity of the separation of thought from action¹⁰ for the working of the system. The economist Dennis Robertson is very critical of this point:

everything is to be settled by the stopwatch and the instruction card: the distinction between planning and execution, the division between the brain users and the muscle users, becomes complete. But even where such thorough-going methods are not in force, the general effect of the progress of industrial technique seems to be to accentuate the divorce of thought from toil at the very time when such divorce has become, from the broader and political point of view, most resented and perhaps most dangerous.

(Robertson 1923: 97)

Robertson has been much affected by Marshall’s teaching and, therefore, this reason of criticism, as will be seen, is also traceable in Marshall’s writings. But there were other reasons of complaint.

The most visible aspect of scientific management that emerges in England before the First World War is the so-called ‘Premium Bonus System’, through which a fundamental incentive is given to each worker in order to maximize his/her productivity. All the other important and peculiar features of scientific management are basically neglected. Premium bonus schemes are the product of a wide interpretation of Taylor’s principles and are very common in British workshops. This aspect is mainly criticized by the unions. In the Trades Union Congress Report, published in 1910, one is told that the premium bonus system ‘was a bad system for the workers, its chief feature being that it created a strong anti-social feeling amongst shopmates. It was a scientific method of squeezing the last ounce of blood from men’ (p. 28). The bonus system is

10 We are told: ‘Taylor had made a central office, the route-ing office, do all the thinking and he endeavoured as far as possible to make the men machines’ (‘Taylorsim’ *The Engineer* 111, 19 May 1911: 520–1).

also criticized by a number of economists: for instance, William Ashley (1922), Sir Dennis Robertson (1921) and Arthur Cecil Pigou (1920).

Another very controversial element is the claimed scientific nature of the new system. Sargent Florence, another economist very close to Marshall's teaching, in writing about this aspect, points out:

It [scientific management] has greatly increased material efficiency and increased it by a conscious direction of attention to points where human factor is increasingly involved. But beyond this its claims are either outside the ken of science or have not a sufficiently scientific foundation.

(Florence 1924: 95)

A further, much criticized aspect concerns the implications of the system on human beings. Taylor's system is charged with transforming each worker into a simple 'appendage' of machinery, to be exploited in order to increase the employer's gains. The system appears to confirm and update the observations Marx had made half a century earlier and had become the butt for labour organizations, trade unions and socialists.¹¹

The English economist John Hobson in *Work and Wealth: A Human Valuation* (1914) is very critical towards scientific management since, according to him, it is 'evident that when we pass from technical improvement of tools to improved methods of working, we open possibilities of opposition between the business and the human interest' (Hobson 1914: 207). Not only by improved methods of work, workers end by working 'extra-hard',¹² but also 'the liberty, initiative, judgement and responsibility of the individual workman are reduced to a minimum' (Hobson 1914: 209). All this means 'a loss or injury to the workers' (Hobson 1914: 212).

Shortly, in Great Britain, the most criticized aspects of scientific management were based on social considerations: its consequences on human beings, its unfairness with regard to the working classes and its deceptive scientific nature. Conversely, the judgement based on technical considera-

11 Indeed, it is a bit surprising that the English Fabian Sydney Webb praises the advantages of scientific management that made American industry more efficient than the English one whose inefficiency 'strikes the intelligent workman' (1918: 135). He also considers the 'study of the job' to be 'all to the good (...) in so far as it has for its motive and object either the discovery of how waste of time or waste of effort can be prevented, or of how to arrive at more precise calculation of bonus times or piecework prices' (1918: 136).

12 This aspect is underlined by Florence: 'Fatigue (...) is one of scientific management's greatest blind spots' (1920: 164).

tions is fairly positive, as Sydney Webb's opinion on scientific management confirms.¹³

All these reasons of criticism are also considered by Marshall, who, however, must have thought they were insufficient in order to give a whole account of the phenomenon. As will be seen, his perspective is much wider and includes other interesting aspects.

3. Marshall's analysis of scientific management

3.1. Role and shapes of economic organization

It is Marshall who first considered industrial organization as the fourth productive factor alongside land, work and capital. The issue of industrial organization is introduced in Book IV of *Principles of Economics* but is more deeply developed in *Industry and Trade*. Marshall's implicit aim pursued in *Industry and Trade* is to understand why, at that time, Britain was losing its economic supremacy in the world.¹⁴ In Book I, 'Some origins of present problems of *Industry and Trade*', Marshall develops a study of industrial organization comparing different places and times.¹⁵ Each country's economic organization and the peculiarity of its industrial leadership are moulded by its geographical and political characteristics and by the character of its population.

For instance, in France, on the one hand, its territory, characterized by a lack of natural communications, does not favour industrial concentration; on the other hand, people's bent for individuality and artistic taste are the

¹³ See note 11.

¹⁴ In the Preface Marshall writes: 'Before the great war she [Britain] was more prosperous than ever : the real incomes of both her well-to-do and her working classes are higher than those of corresponding classes in any other densely peopled country; and the methods of her industry have advanced at an ever increasing rate. But yet *she has in some respects lost leadership*. Her best methods are now common property of the Western World; and recent advances in them have been very largely due to the enterprise and inventive faculties of other countries; and recent advances in them have been very largely due to the enterprise and inventive faculties of other countries. The maintenance of her material well-being above that of other countries of Europe, in spite of some *relative* slackening of the industrial initiative by which she achieved her success, cannot be expected to last for ever. That it should have been maintained till now is marvellous, and calls for study. We need to know on what Britain's leadership was based; and *how it may be conserved, and perhaps even enlarged again.*' (1919: 3).

¹⁵ He considers particularly Germany, USA, Britain and France from their earlier economic development to current times.

source of its economic leadership based on the production of fine goods. In Germany, the presence of natural and artificial facilities for a wide communication foster its cultural more than its political unity; and the importance given to culture and education encourages progressive industries and scientific methods applied to production. In the USA, the huge expanse and the incredible development of railways and the different races of the population cause a very wide and homogeneous market demand and foster a multiform standardization and large-scale production.

The historical excursus of Book I helps to understand the causes of the modern tendencies that were then progressively shaping the modern economies: massive production and the growth of business size. In Book II, 'Dominant Tendencies of Business Organization', Marshall investigates the characteristic aspects of those modern tendencies. Particularly, he analyses standardization, technical influences on the size of firms, role and importance of marketing, characteristics of modern organization and, of course, scientific management.

The analysis of scientific management is developed in chapters XI and XII of Book II but many other observations are spread throughout the whole volume, since scientific management is related to many other aspects considered in *Industry and Trade*. Marshall describes scientific management in a very detailed way and demonstrates that he knows all the most important books¹⁶ and articles¹⁷ on that subject. At first sight, Marshall's opinion on scientific management could indeed seem (cautiously) positive, as underlined by Whitaker. Marshall, for instance, writes that scientific management: 'has in great measure made good its claim to carry the application of scientific methods to the broader problems of business, much further than they had been carried before (1919: 368)

Besides, even though 'many of its chief proposals have been applied by able business men in past times', it has given them such coherence, and power of progressive development by aid of organized records, that it

16 In the Marshall Library of Economics Catalogue (1937), a list of Marshall's books is given. The list, compiled by his wife Mary, includes a great deal of books on scientific management. Among them we find Münsterberg (1913), Hoxie (1915), Taylor (1903, 1911), Thompson (1914a,b), Drury (1915). A number of books have also interesting annotations by Marshall (see particularly Amos Tuck School of Business Administration 1912; Scott 1912, Münsterberg 1913).

17 In the Marshall Library Archive, Cambridge, in the bound volumes with the articles collected by Marshall (see Caldari 2000, 2003) there are articles by Morris L. Cooke (1913), Gilbreth (1913), C.B. Thompson (1913, 1914a,b, 1915), Hoxie (1916), Walker (1913) and Taylor (1895, 1903). In addition, there are a significant number of articles (227) from the *Engineering Magazine* and *The Engineer*.

seems likely to influence economic advance on many sides' (Marshall 1919: 368).

But reading carefully those two chapters, one finds that Marshall's attitude towards scientific management is more negative and critical than it appears at first sight, as will be shown in the following sections.

3.2. The two main drifts of scientific management: the cumbersome presence of the Planning Department

According to Marshall, scientific management has two main implications:

one main drift (...) is towards concentration, combined with specialization of control in regard to all matters that require thought and judgement (...) [The] second main drift (...) may be epitomized in the phrase that traditional methods of work, and especially manual work are 'excellent servant, but no good masters.

(Marshall 1919: 369–70)

The result of the first drift is an extreme division of mental labour; that of the second drift is a reorganization, a change of traditional methods of work through ergonomic and 'Time and Motion' studies.

Both tendencies lead to the Planning Department, considered by Marshall as the best starting point in approaching scientific management. The department, where specialized engineers prepare detailed instructions for each activity of the productive process, has replaced the control by the foremen in traditionally organized firms. Through the department, productive process becomes 'rationalized' (i.e. scientifically organized) and very efficient. The department establishes roles, skills, time and motion for each operation and writes painstaking instructions for each worker on a card.¹⁸

In spite of its efficiency, Marshall does not see the department favourably: rather, he considers it a 'cumbersome' presence. The rigid determination of roles and functions restricts individual enterprise to the higher ranks in the Planning Department: decisions are taken at the higher level (engineers) while the lower levels (workers) must execute very detailed and fixed orders. This system is very efficient from a productive point of view but, Marshall notes: 'doubts begin to rise when advocates of the new order hint that (...) a great part of the mental work, which used to be committed to operatives and foremen, will be absorbed by the Planning

18 'The chief outward token of the new plan is the elaboration of a system of cards so full, and so carefully organized that then central control shall have a firm basis for arranging the details of its work' (Marshall 1919: 369).

Department' (Marshall 1919: 387). With the new system, unskilled workers can perform activities once performed by skilled ones and very often can gain high wages: 'These are great achievements: and yet we are bound to reflect that the effects of taking away from the operative any duty, save that of carrying out his instructions carefully, *are not likely to be altogether good*' (Marshall 1919: 388).

The reasons for thinking that those achievements 'are not likely to be altogether good' are many and provide the grounds for Marshall's criticism of scientific management. As will now be seen, his criticism is based not only on social but also on technical considerations.

3.3. From personal to 'card' relationship

Scientific management proves to have a great capacity: it increases workers' efficiency and has the potential to become the source of economic success, as demonstrated by the United States:¹⁹

Such a system, when thoroughly set up, and worked by able and enthusiastic adherents, may not improbably turn the existing faculties of the operative to the best account in the production of material wealth. It is not irrelevant to remark that international comparative statistics show the output per head in engineering industries to be a great deal higher in America than anywhere else.

(Marshall 1919: 374)

Scientific management gives rise to a structure characterized by a clear division of roles and functions. A similar division of labour is necessarily also present in the traditionally organized large firms, but between the two kinds of industrial organization there is an important difference:

Whereas the operative was under the exclusive direction and influence of a single foreman for nearly all purposes; under the new system he takes order in regard to different sides of his work from eight (...) [or more] specialized foremen, commonly called 'bosses.

(Marshall 1919: 373)

Each boss is only a technical guide over a narrow area for a large number of workmen and does not have any personal connection with them: the relationship between bosses and workers becomes 'slight and impersonal', fails to originate the important interchange among the various parts of the firm and hinders the free expression of individual capacity. Personal relationship is replaced with a transmission of written orders that take the

¹⁹ 'The output per head in engineering industries (...) [are] a great deal higher in America than anywhere else' (Marshall 1919: 374).

place of personal controls made in the small and medium size firms by the entrepreneur, 'whose eye is everywhere' (Marshall 1919: 366). But it is not the same thing since:

The relations of an employer to his employees generally contain some elements which have little connection with business: and even from a merely business point of view, account is to be taken of the fact that the trust, esteem and affection of his staff are a valuable business asset, of a kind which his *machinery cannot supply*.

(Marshall 1919: 351)

This is one of the reasons why Marshall promotes small and medium size firms, as will be shown in section 4.

3.4. *The waste of individual endowment*

Another aspect of scientific management criticized by Marshall is correlated with the extreme division of labour and standardization that the new system implied. Standardization in itself is not an evil, on the contrary: 'it embodies the progressive evolution of improved techniques' (Marshall 1919: 201). Nonetheless, standardization can be also injurious.

Marshall (1919: 227) distinguishes between 'standardization of components parts' and 'standardization of complex structures': the former is a more flexible standardization, typical of small and medium businesses, and useful for further changes; the latter is, on the contrary, very stiff and characterizes large firms; it is this kind of standardization that, according to Marshall: 'goes together with a certain decline in the place held in that industry by the high faculties of initiative' (Marshall 1919: 243).

When a productive activity is subdivided into several sub-activities it is necessary to coordinate them. But the coordination of a large number of activities necessarily originates a structural rigidity and, consequently, a limited possibility for each individual of expressing his/her creativity: each worker has a very well-determined task and the efficiency of the whole productive process depends on how closely the instructions are followed. The productive efficiency is very high but this is achieved at a price: the impoverishment of the creative capacity of each individual, who has always to perform the same simple, repetitive task.²⁰ But, according to Marshall, industrial leadership depends on 'individuality and creative faculty'. Indeed, it must depend on it in order to contribute to progress, that is, not simply material wealth. In *Industry and Trade* Marshall aims to 'inquire how far the multiplication of semi-automatic machines, in the control of

20 'The men in the shop follow their instructions; they are not required to use any forethought, or any considerable discretion' (Marshall 1919: 375).

which a man is not required to use any high faculty, is a real benefit of the world' (Marshall 1919: 152) and his conclusion is that: 'the substitution of repetition work in massive standardized production, (...), is not an advance, from the human point of view, over skilled handicraft: it increases man's power over matter; but it may diminish his power over himself' (Marshall 1919: 683).

Industrial concentration, one of the two main drifts of scientific management, on the one hand, gives rise to rational coordination and efficiency, on the other hand, risks underrating the main mover of production, that is, man. According to the new system, each worker must perform the task assigned to him by engineers and foremen after they have 'studied' his capacity. On the basis of this study, they decide a priori what that workman has to do: 'Foremen and other subordinate officials have some interest in getting the most work that they can out of each man *as he is*, but they seldom take account of what he might possibly become' (Marshall 1919: 352). The foremen and other officials of medium grades are not always quick to appreciate fully any higher qualities that may be latent in a young artisan: they judge him probably by his output; but that, although a good measure of his value as an operative is a very poor measure of his higher capabilities (Marshall 1919: 662).

However, this practice can be self-defeating, not only for the business itself, which, in this manner, can miss the opportunity of taking advantage of potential resources but also and, moreover, for society that is likely to waste its more important kind of capital. Frederick Taylor and Henry Ford are two revealing examples, since both started their career as simple operatives (Marshall 1919: 237–8, 368, 371, 374–5, 386–7).

3.5. The rigid structure of firms

In traditionally organized large businesses, the head attends to general strategic matters while all the remaining work is attended to by the other departments: also in the traditional firms, therefore, there is a (necessary) division of (mental) work. But, as Marshall points out: 'under scientific management details are worked out in advance; partly in order that working "instruction cards" may be prepared for every operative' (1919: 372).

Each operative has to follow their instructions and repeat the same operation for hours without any possibility of using their individual initiative. The details of each operation are written in advance (on the cards) but this means that once an operation is fixed and its details are worked out by the Planning Department, nothing can be changed by the operative until another decision is taken by the department. This also means that the

structure of the firm becomes rigid because nothing can be changed or decided on the spot. This is a dangerous limit for the firm because it cannot adjust to changes of the economic atmosphere that, according to Marshall, 'is never quite still' (Marshall 1919: 51).

On the other hand, the operative becomes a gear of the machine and cannot decide, choose and think. The business is no longer an 'organism' but becomes a fossil,²¹ especially when the typical rigidity of large-scale firms is strengthened by scientific management.

Along with the increase of efficiency, Marshall underlines many problems connected with scientific management. On the one hand, he stresses its negative effects on human beings; on the other hand, he considers scientific management on the technical side, highlighting the limits of large structures and standardization. Scientific management is efficient from a technical point of view, but this efficiency in the long run could develop into a dangerous inefficiency. According to Marshall, a rigid structure of firms in the short run allows a high efficiency but in the long run can be a cumbersome hindrance for a firm that is prevented from changing. Marshall's criticism is not an end in itself: he criticizes the features of scientific management developing interesting arguments, which will now be considered.

4. The grounds of Marshall's criticism

4.1. *Small vs. large firms*

In *Industry and Trade*, along with the careful analysis of scientific management and the acknowledgment that 'large size' is the (almost) inexorable trend of the modern industrial time,²² Marshall emphasizes the importance of small and medium firms. Industrial reality is and must be made, for Marshall, of small, medium and large firms: each type of firm has good reasons for existing and has its own advantages and disadvantages.²³ To large firms Marshall does not oppose small firms but weak firms,

21 'A tendency to ossification of the social organism might therefore be feared as the result of bureaucratic habits of shirking troublesome initiative' (Marshall 1919: 325).

22 As he notes: 'everyone is aware of the tendency to an increase in the size of individual businesses' (Marshall 1897: 307).

23 'One of the most impressive achievements of modern technique is its power to handle masses too great for any force which was at man's command until recently. But, as often happens, that which is most wonderful, is not that which has exercised the greatest influence on the course of evolution. Those industries

without initiative and innovative aim, leaving the dimension out of consideration since 'the chief need of the large majority of modern industries is for alert intelligence, good judgement, promptness and trustworthiness in conduct on the part of the more responsible employees' (Marshall 1919: 168).

However, 'size' matters and makes an important difference in terms of productivity and technical efficiency. Marshall does not ignore this aspect and recognizes that small firms have many disadvantages compared with large firms.²⁴ Nevertheless, in an early work he underlines that: 'small factories, whatever their numbers, will be at great disadvantage relative to large unless many of them are collected together in the same district' (Marshall and Paley Marshall 1879: 53). According to Marshall, industrial districts can compete with large integrated businesses;²⁵ he makes references to them in several parts of his writings even during the analysis of scientific management.

In the second chapter of *Industry and Trade*, dedicated to scientific management, Marshall deals with the second important drift of scientific management, which states that traditional methods of labour are considered obsolete and must be changed. This implication of scientific management is less developed than the first one and is worked out in chapter XII, where Marshall deals with the remunerative problem under scientific management.

The Planning Department must analyse and perfect each operation as well as its remuneration: it records every quantity of product and time spent to produce it and determines a fix wage rate. This wage rate is considered *absolute* for, in the first place, its standard rates depend on a less degree, than do those reached by older methods, on specific customs relating to each particular task; and, in the second place, they claim to have a foundation in the mechanics of elemental movements of the human body, the measure-

which need to handle very large single masses must necessarily be concentrated in the hands of a relatively small number of large businesses; *but they are not numerous* (Marshall 1919: 217–18). It is true that giant businesses alone are capable of some of the chief tasks of industry in the present age. But, where their presence is not demanded *by technical considerations*, the immediate increase of strength, which would result from a rapid enlargement of their sway, might be purchased at *too great price: the value of (...) free individuality* (Marshall 1919: 577–8).

24 Especially in regard to modern aspects of management: 'Nearly the maximum economy of production can often be attained by a well organized business of moderate size: but (...) the task of marketing efficiently over a large area makes demand for almost unlimited capitalistic resources' (Marshall 1919: 511).

25 See Becattini (1990, 2003), Raffaelli (2003).

ments of which have something of that aloofness from irrelevant accidents, which belongs to laboratory experiments (Marshall 1919: 384).

However, to fix an absolute wage rate is substantially meaningless because it is 'liable to be altered by changes in economic circumstances' (Marshall 1919: 384). The custom of fixing an absolute rate of wage for a kind of work performed under the same conditions is not an invention of scientific management leaders but is 'found in industries in which almost precisely the same task has long been performed by many thousands of workers in almost the same way. Especially in the Lancashire cotton industry the standard piece-rate of wages is a true standard rate' (Marshall 1919: 382–3).

The experience developed over several years makes it possible to define a 'standard' rate of wage, which is not intended to be absolute but simply the rate that guarantees an equal remuneration for equally efficient workers occupied in different factories. The reference to the Lancashire industrial district is made twice in the chapters dedicated to scientific management and is less accidental – it is thought – than it appears at first reading. Industrial districts are characterized by external economies that are 'dependent on the general development of the industry' (Marshall 1920: 266). In the *Pure Theory of Domestic Values* to large firms, Marshall opposes firms collected in a district:

The advantages of production on a large scale can in general be as well attained by the aggregation of a large number of small masters into one district as by the erection of a few large works. It is true that the disadvantages under which the small masters lie in the competition with large firms are increasing more rapidly than are their peculiar advantages; and that in most though not in all directions there is a tendency for small masters to be supplanted. But in the metal trades (...) and in many others the advantages which are generally classed under the heads of division of labour and production on a large scale can be obtained almost as fully by the aggregation into one district of many establishment of a moderate size as by the erection of a few huge factories.

(Whitaker 1975, vol. II: 196)

Firms collected in a district can compete with very large firms and achieve important advantages for three main reasons:

Firstly (...) it is possible to divide the process of production into several stages, each of which can be performed with the maximum of economy in a small establishment; (...) Secondly (...) when large masses of men in the same locality are engaged in similar tasks, it is found that, by associating with one another, they educate one another. (...) Thirdly, (...) when the total number of men interested (...) [in a particular industry] is very large there are to be found among them many who, by their intellect and temper, are fitted to originate new ideas.

(Whitaker 1975: 196–8)

In a district, there is a special ‘atmosphere’ that makes human relationship easier and furthers ideas and information so that the district becomes an important drive of innovation. The presence of that ‘atmosphere’ is the chief distinction of an industrial district compared with a large firm. For instance, the districts of Sheffield and Solingen have acquired industrial ‘atmospheres’ of their own; which yield great advantages gratis to the manufactures of cutlery, which are not easily to be had elsewhere: and *an atmosphere cannot be moved* (Marshall 1919: 284).

That ‘atmosphere’ needs a long time to set and develop. Experience and the cumulative growth of knowledge enable districts to meet external changes. In a district, each firm specializes in a stage of productive process: each stage is not isolated but related to the others. In a district, firms are in competition with one another but among them there is also cooperation: in fact: ‘The broadest and in some respects most efficient forms of cooperation are seen in a great industrial district where numerous specialized branches of industry have been welded almost automatically into an organic whole’ (Marshall 1919: 599).

Obviously, also in large firms the numerous parts must cooperate but, in order to cooperate, they must be coordinated, as in the system of cards conceived by Taylor. On the contrary, in a district cooperation is automatic, unconscious and less expensive than in a large firm (Marshall 1919: 366).

4.2. The ingredients of progress

Marshall has this critical attitude towards large firms from the beginning of his economic studies, as is proved by the *Early Economic Writings* published by Whitaker (1975). In large firms, bureaucracy and routines prevent business from quickly adapting to exogenous changes:

[the] accountant’s work for every department must be full and precise; and so arranged as to be part of a system of elaborate checks and counterchecks. Such system is necessarily wasteful of effort, and hostile to elasticity (...). In so far as a system of checks represses elasticity and initiative, it is an injury to the community as well as to the company.

(Marshall 1919: 324)

According to Marshall, large size involves structural rigidity, a *vis inertiae* that represses individual and business initiative and moreover arrests the fundamental push to progress. Conversely, each individual should be able to express his/her capacity and creativity and this is far easier in small and medium size firms where ‘each employee can be to a certain extent treated *as an individual human being*’ (Marshall 1919: 352). This explains why small firms are, for Marshall, ‘the best educators of the initiative and versatility,

which are the chief sources of industrial progress' (Marshall 1919: 249). Progress is considered the core and the aim of his economic studies. According to Marshall:

Progress has many sides. It includes development of mental and moral faculties, even when their exercise yields no material gain. The term progress is narrow and it is sometimes taken to imply merely an increase in mans command over the material requisites of physical mental and moral well-being, no special reference being made to the extent to which this command is turned to account in developing the higher life of mankind. When increase of material wealth is united with the solidity of character sufficient to turn it to good account. (...) True human progress is in the main an advance in capacity for feeling and for thought, yet it cannot be sustained without vigorous enterprise and energy.

(Marshall Library Archive, Red Box 1 (3), Identity Code: Marshall 5/3/1)

Progress, therefore, does not identify only with an increment of 'wealth' but involves other and more important factors since, as pointed out in the *Principles*: 'the production of wealth is but a means to the sustenance of man; to the satisfaction of his wants; and to the development of his activities, physical, mental and moral' (Marshall 1920: 173). According to Marshall, progress embodies vigour, health, energy, creativity, initiative and versatility. Many of these aspects are clearly in contrast with rigidity, bureaucracy, order and the various features that characterize large firms and scientific management: therefore, scientific management and large firms may be fairly considered in contrast with progress.

5. Some conclusive remarks

During the 1960s and 1970s, many events produce the crisis of the Taylorist and Fordist model.²⁶ Among the defects attributed to the Fordist model, the most serious is the lack of flexibility. During the 1970s, economists drew attention to two important phenomena: the surprising vitality of small and medium firms, especially when collected in an industrial district; and the tendency of large firms to realize a flexible (massive) production in order to survive in the market. Flexibility becomes the key word of what is now called post-Fordism.

26 Although Ford's philosophy was different from Taylor's principles, the two are seen as almost the same thing.

Scientific management made some 'obvious criticism'²⁷ obsolete, as Marshall foresaw (1919: 375), but was unprepared to face the real world change that Marshall never ignored.

In a recent work, Garud and Kotha (1994) contrast scientific management with flexible production systems. The principles of scientific management 'had the intended consequence of creating a trade-off between product variety and production cost' (1994: 672) but more recently, flexibility proved 'critical for survival in industries characterized by rapid change and diverse product market' (1994: 671). Interestingly, in order to illustrate their reasoning, the authors use the structure and functioning of the human brain as a metaphor. Moreover, they underline the close analogy between the way in which flexible production systems work and the functioning of the human brain. The use of the human brain as a metaphor is not new, especially in industrial analysis. What is more interesting is that it is also the main topic of Marshall's early philosophical studies: in *Ye Machine*, one of the early philosophical writings recently published by Raffaelli (1990a,b, 1991, 1994a,b, 2003), Marshall describes the mind-body relationship and investigates how the human mind works. The mind is an 'evolving self-organization' and 'grows' with experience. The mind 'changes while acting' and the 'acquisition of knowledge is a never-ending process' (Raffaelli 2003: 35); human actions and mental processes are based on a mixture of standardization, other automatic connections and (necessarily) variation. External changes and prods call for mental and physical reactions: through the process of trial and error, man tries to face unknown and uncommon events. Successful trials are likely to be repeated and therefore to become 'routine'. Man uses the same routine when he has to deal with the same or an analogous situation. Human actions and mental processes consist of a certain number of routines but there must also be a degree of freedom, since new events continually take place: the human mind must be free to start new processes of trial and selection.

The human brain (as in *Ye Machine*) and flexible production systems both must exhibit the ability to change, evolve and create. Both have the possibility of using imagination, which Marshall considered a very important intellectual faculty, together with perception and reason. Indeed, for him, imagination is a very important faculty as clear from the following passage: '*most of all he [the economist] needs imagination, to put him on the track of those causes of visible events which are remote or lie below the surface, and of those effects of visible causes which are remote or lie below the surface*' (Marshall 1920: 43). Imagination allows one to face (and often to solve) complex problems, especially with regard to the distant

27 E.g. the criticism founded on human-social considerations.

future.²⁸ Imagination ‘creates movement’ (Marshall 1919: 203) and is a key element in an evolving changing milieu.

The great problem connected with large firms and scientific management is the lack of the characteristics that set men’s imagination. Bureaucracy rules, rigidity banishes everything except standardized actions and activities and therefore they banish the possibility of men freely using their own imagination, being creative and facing unknown and unexpected situations.

Knowing Marshall’s analysis of ‘the brain machine’ is useful for better understanding his attitude towards large firms, standardization and scientific management: if one goes back to his industrial analysis, one can see how much of it is related to his early reflections on ‘the machine’.

First, firms are part of a changing environment and must react to its stimuli. The capacity of adapting and flexibility are fundamental characteristics of firms that are part of an evolutive environment, but in a large firm structural rigidity interferes with them. Second, even in large firms, it is necessary that there be a proportion between standardization and variation; for this reason Marshall maintains that the ‘standardization of components parts’, more flexible and typical of small and medium firms, ‘is at once more productive of economy and less hostile to progress than that of complex structures’ (Marshall 1919: 227).

Marshall considers the division of labour an essential condition for (every kind of) organization, according to Smith’s lesson, enriched by Babbage’s (1832) work. Nevertheless, Marshall, as well as Smith, stresses the defects of excessive specialization and division of labour, affirming the importance of creativity, freedom and individuality. Third, individual freedom is also important from an economic point of view: when workers can freely express their own capacity and are not constrained to do a narrow, strict and unchangeable task, the firm in which they work is more able to innovate and to face external changes. This last aspect becomes more important the more complex the economic system becomes.

In his 1999 paper, Whitaker rightly underlines that ‘Marshall’s dominant concern had long been with the dynamic efficiency of the economy – its effectiveness in promoting economic change and especially in creating new knowledge and new ways of doing things. Also, he had always valued

28 He writes: ‘In smaller matters, indeed, simple experience will suggest the unseen. It will, for instance, put people in the way of looking for the harm to strength of character and to family life that comes from ill-considered aid to the thriftless; even though what is seen on the surface is almost sheer gain. But greater effort, a larger range of view, *a more powerful exercise of the imagination* are needed in tracking the true results of, for instance, many plausible schemes for increasing steadiness of employment’ (Marshall 1920: 44).

production more as a necessary means to the improvement of mankind than as an end in itself'. But he concludes: 'his [Marshall's] failure to emphasize potential threats that scientific management might pose to both dynamic efficiency and human betterment is thus doubly surprising' (Whitaker 1999: 265).

With the help of *Ye Machine*, one can now better understand why scientific management banishes the possibility of using imagination 'on the spot' and does not allow human creativity to express itself: one knows, therefore, that Marshall's criticism of scientific management is justified by the opinion that it could be a dangerous hindrance to progress. Moreover, it is known that progress relates to man's qualities and that scientific management could not be considered, by Marshall, as a means for human betterment, in the long run.

This is the point where the author's opinion diverges from Whitaker's. In point of truth, when Whitaker wrote his paper, the potentiality of *Ye Machine* in terms of interpretation of Marshall's thought was not fully recognized. *Ye Machine* and Marshall's opinions on progress give one the possibility of perceiving the reasons of his criticism of large firms and scientific management; moreover, they underline the importance of knowing economists' intellectual background for interpreting and understanding their thoughts.

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Abstract

In *Industry and Trade*, ‘A study of industrial technique and business organization; and of their influences on the conditions of various classes and nations’ (1919), Alfred Marshall develops a detailed analysis of scientific management, emphasizing not only its unquestionable advantages but also its dangerous limits. Although in the literature Marshall’s

evaluation of scientific management has been considered rather positive, the author has found it sceptical and definitively critical in many passages of his book. This paper deals with Marshall's analysis in order to underline the reasons why he criticizes Taylor's system, which, at that time, sounded like the greatest expression of modernity.

Keywords

Scientific management, industrial organization, division of labour, progress

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