Recent Trends in Scientific Management

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Management Defined

The management may be broadly defined as the art of applying the economic principles that underlie the control of men and materials in the enterprise under consideration. It makes itself manifest through organization; and since the principles underlying various enterprises very greatly, it is natural that the forms of organization must be also very greatly considered with the character and magnitude of the business. It would be reasonable to assume that if the economic laws or philosophy underlying the accomplishment of any undertaking can be discovered and recorded, they will form a guide for the management of all similar enterprises. It does not follow, however, that any man who knows these economic laws can be a successful administrator. Two men may be given the same equipment of machine and knowledge; one will be successful, and the other will fail. The basic facts or law of any field are impersonal, but their execution or administration almost always involves personal qualifications on which success or failure may, and usually does, depend. In other words, there may be a science of management and an art of management just as there is a science and art in plant building, aviation, agriculture and other lines of human endeavor. The question as to how far the art of management may be considered to have a scientific foundation has been the cause of a considerable discussion which may bear further investigation. This naturally leads to an inquiry as to what constitute a scientific foundation in any activity.

Fundamental Laws of Industrial Activity

The fundamental laws that underlie any art or any industrial activity are either qualitative or quantitative. Thus the engineer may know that all beams will deflect when loaded. If, however, the knowledge of the engineer does not go beyond these limits, the fundamental laws governing the portion of respective arts are known qualitatively only. Qualitative knowledge is often expressed empirically, that is, in terms that only approximately express the true relation existing between the causes and affects considered.

If, however, the engineer can predict that a given weight will deflect a given beam a definite amount, he also knows the law of deflection of such beams quantitatively.

The principles that underlie any art become known through experience, and the degree to which they may become known depends largely on the amount of such science and the effects made to record and interpret it. In the early stages of any art such knowledge of the fundamental laws as may exist must exist as a part of the personal knowledge of some man or men. And even after these laws are known quantitatively, they are still often preserved by being passed from father to son or from workman to apprentice without record of any kind.

Quantitative knowledge, however, involves the measurement of cause and effect, and laws are fully known only when such measurement has been made in sufficient number to demonstrate beyond doubt the exact quantitative relations existing among the phenomena considered. And only where the laws of an art are fully known both qualitatively and quantitatively can it be said to rest fully on a scientific basis. Up to date only a part of our general knowledge is quantitative in character, the major part of it, which lies outside pure and applied science, being empirical in character; in fact, much that lies in these fields is not fully known quantitatively.

The scientific method, which first collects all the data or facts concerning the problem, analyzes them and deduces therefrom logical conclusion, and then applies these conclusions to the predictions of results, is of supreme importance in all kinds of work. Scientific management, so called, is not a code of rules as much as it is an attitude of mind that replace "I think" with "I know", and the extent to which this can be accomplished will depend on how far the principles involved can be developed quantitatively.

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All branches of human activity have risen above the stage of empiricism and rule of thumb only as they have been able to build upon the accumulated facts of experience and accurate conclusions drawn therefrom. Industrial organization and management are not exception to this rule. Until quite recently the industrial management has been largely personal, rule of thumb method, based on experience only, being almost universally used in all matters. The need of more accurate information, especially in administering large enterprises has led, however, to a more careful examination of the art of management with a view to finding if any basic principle existed that might serve as a safer guide than the cruder empirical methods, and with the hope that the better understanding and more accurate solution of these problems would come with a further understanding of these basic laws.

Such basic laws do exist, and the term industrial engineer is becoming synonymous with one skilled in factory design, organization and operation, who endeavours to rest his conclusions, not on simple approximate information or judgment, but, as far as possible, upon basic proved facts. The scientific method, which first observes and records the data of the phenomena concerned, then deduces the fundamental laws of the phenomena from these data, and lastly applies these deductions to predict other results, has come to stay in all lines of human activity. Just as the designing engineer endeavors to attain highest efficiency by eliminating energy losses, so the industrial engineer is a close student of wastes in manufacturing processes. Just as a designing engineer seeks to rest his work on accurate data and scientific facts, so the industrial engineer seeks to observe, record and formulate the data of industrial operation and industrial management in order that he may accurately predict the results of other operations and managements. His field is indeed a wide one, ranging from the collection of statistical data of the industry as a whole down to the shipping of the factory products, and his sources of knowledge have their roots in engineering, economics, psychology, and other fields of human experience. These relations and conditions apply in general, to all forms of industry, but apply with special force to industries involving congregated labor, as found in manufacturing plants, and a discussion of the special problems found in organized manufacturing will exemplify those of almost any other form of industry. These general principles apply also to all phases of manufacturing industry, including construction, equipment and operation.

Several titles have been used to denote this new field. It was first called scientific management, but this name was perhaps not well chosen and has created some antagonism to the use of these principles, partly because of a lack of knowledge regarding the basic facts and partly because of a well-grounded fear that there is a grave danger in extending to the extreme some of the methods advocated. At present there is a tendency to apply the name of industrial engineering to the more technical aspects of management and the name of administrative engineering to what may be called the business side of management, in which the engineer has been found useful. Whatever the name may be applied to this work, it is certain that the scientific method of attacking the problem of organization and management is correct and that it points out the method of intelligently directing the construction and arrangement of factory buildings, the character of methods and processes, the organizations of departments, the elimination of wastes, and the increase of efficiency in all phases of industrial administrations where data and experience are available.

It should be especially noted, however, that scientific data and system can never take a place of personality. Personality has always been and will always remain the great moving force in human affairs. But the personality alone is no longer sufficient where classified knowledge is a factor in the affairs considered. All other things being equal, the knowledge rests with the man who possesses the greatest amount of scientific knowledge.

Economic Distribution

Today production problems in America has been mostly solved. But the great problem that confront us is not that of production but that of economic distribution. More manufactured goods can be produced than can be used and far more that are needed to make all of us comfortable. All the new production processes that can be invented will throw little light on the problem of why, in many places, at one time, storehouses are found filled with raw material, idle factories equipped with the fine tools, and people walking the streets without food or clothing, yet willing to work.

The problem is too complex to be solved by the simple expedient of increased production. There still remain the question of competition, unfair taxation, wasteful governmental ex-

penditures, tariff and monetary problems, immigration and dozen other factors that are not as yet within the control of the employer, be he ever so fair minded, or of the employee, be he ever so strongly organized. It may be that the readjustment of some of these would do so much for all workers, both employers and employees, as would a large increase of production power. What is most needed is scientific distribution. This is true not only of manufactured goods but markedly so of agricultural products where the cost of marketing is a disgrace to our intelligence. Thus the problem of production in general is solved; the problem of equitable and stable distribution still awaits solution.

Scientific Management and Government

Scientific methods have long since spread from the engineering and production phases of industry to all forms of industrial and commercial management. Little attempt has been made, however, to apply these methods to the problems of government.

In recent times proposals were made that the engineer, because of his intimate knowledge of the industrial basis of our national life, should have a larger part in government. This idea has been put forward seriously under the name of technocracy, that is, by inference, government by technicians or in a more popular sense by engineers. Unquestionably where facts or tangible evidence can be obtained, the scientific method is very effective in arriving at accurate conclusion, and the engineer is in a peculiarly advantageous position for obtaining such tangible evidence as can be gathered from the industrial field. However, in the case of our more difficult problems in general economics and government, exact facts and tangible evidence are not easy to obtain and often times the evidence is voluminous and conflicting. In many cases the well trained businessman, economist and lawyer are at least as capable of drawing an accurate conclusion as anyone else.

What is needed, apparently, is not government by technicians but a reorganization of our government, both national and local by functions just as has been done by successful industry. The greatest problem would be the means of finding adequate personnel for these functions and yet retaining our democratic form of government. At present time attempts are made to secure functional advice by the appointment of governmental commissions whose recommendations congress may or may not adopt. But until government is conducted by men with special training and knowledge such as are to be found in large industrial organizations, there would appear to be little hope of an intelligent national, state and city administration.

Scientific Management and Human Relation

Today the principles governing human relations permeate every corner of industry, modifying and controlling other factors as never before. They are ever present and cannot for an instant be forgotten or ignored. Until very recently these relations were looked upon as being entirely personal. It was supposed that the personality, as expressed in leadership, was the one great force in controlling the relations of men to each other. It is still true and will always remain true that leadership is a prime essential in the success of any enterprise involving human relations, but even here cold, scientific methods have shown that some of these matters can be measured and the result recorded, and this has brought new problems into the administration of human affairs.

Motion study has shown that inherited methods of doing work are in many cases most wasteful and can be greatly improved by analytical study. Furthermore, experimental data can be recorded here also, thus making it possible to build up synthetically a predicted sequence of operations that is much more efficient than those which came as a result of empirical and inherited methods.

It is now clearly recognized that if men are to put forth their best bodily efforts, they must be well fed, well housed and well clothed. Aside of all philanthropic ideas, it is found that the physical care of men yields dividends. This thought, however, is comparatively new to many and not many years ago the employer gave far better attention to the care of his horse than he did to his man. If it is true of bodily effort, it is even more true of mental effort. The cost of production does not depend upon the wage rate but upon the unit wage cost which is a function of quantity, and quantity of output depends on mental and physical strength. It should be noted that the caring of the physical welfare of employees is not an act of charity, and if conducted in any spirit of patronage it is fatal to management.

Of equal importance is the principle that it pays to teach men the best method by

which work can be done. This is in strict accord with all human experience; yet the backward state of the educational side of factory management is startling. Even the much lauded old apprenticeship systems are not, as a rule, educational in a true sense. The apprentice was given the opportunity to learn by observation and absorption but was rarely taught. Is it any wonder that the accumulated errors and the wasteful methods of the trade persisted? If time and motion study has done no other services than to call attention to this fact, they have rendered a good service. It is rapidly recognized that the increased refinement in methods and the higher requirements for the worker can be met only when coupled with proper methods of instruction. It is not sufficient to set standards that only few men can reach to the arbitrary exclusion of all others. Every man should be educated industrially to his highest capacity in the work for which he is best fitted, and every man should be given an opportunity to produce to the best of his ability and rewarded accordingly. This implies a changed point of view not only on the part of our public schools but on the part of the factory management also. The work of H.L. Gantt in training men not only in skill but in habits of industry is worthy of special attention. The setting of standards of performance means very little, after all, unless these standards are high, and if they are high, they can be reached by the majority of workmen only after careful training and preparation.

The greater the output per manhour the greater will be the surplus of production that may be distributed to the worker. It has been demonstrated that in the long run increased production has benefitted all men. It would, therefore, seem reasonable that the employer should use such scientific data as he may have to select men properly matching the requirement of the position with the characteristics of the man. It would seem that he is justified in measuring, if he can, what a fair day's work should be and paying only a day's wage for a day's work. There is, in fact, no logical argument against the full use of the analytical or scientific method in attacking any problem in industry. If all men could be brought to realize the economic advantage of this method of attack over empirical and rule-of-thumb methods, the standard of production would rise tremendously.

But, on the other hand, it must be recognized by the employer that he can no longer introduce any or all methods into his shop at will. Today the mechanical side of the factory equipment cannot be changed at pleasure and the human portion of the equipment moulded to suit the mechanical part. A new industrial day has dawned in which profits are not the most important factor. More and more industry is coming to be looked upon as a means of supporting human existence and not as a means of corporate profit. Public opinion has become increasingly critical regarding changes in industrial methods. Men have become of more interest than machine.

Today laborsaving methods of management differ little in their ultimate economic efforts from those of labor saving machinery. They differ in their application in that laborsaving or scientific management is much more personal in its character and affects the worker much more intimately.

Because of their economic soundness the new methods will continue to grow in use, just as applied science grows in use in all lines of human endeavor. As long as our present ideas of civilization prevail and the society holds that the greatest good to the greatest number comes through abundant production of commodities, there can be no reasonable objection to the employer's possessing the most refined knowledge of the laws of production. But there is also, a constantly increasing objection on the part of the society to the use of such refined knowledge as a means of oppression. Fortunately, progressive employers have no desire so to use these new production methods, and it is not likely that any degradation of labor such as followed the introduction of modern machine methods will result from the introduction of these timesaving methods. Indeed, at times it would appear as though labor and not capital is the more oppressive through the excessive use of protection measures.

Why does the worker naturally resist these new methods? First because the great majority of men are naturally afraid of all new things that they do not understand and the effect of which they cannot clearly foresee. It is very evident to the worker that time and motion study puts into the hands of the employer a much powerful selection agency that he has hitherto possessed, and the worker is justly afraid of these scientific methods in the hand of unscientific, unscrupulous, and the ignorant employer. If this selective power is used solely for the purpose of sorting men so as to eliminate indolent and those who are clearly unfitted for the work in hand, no objection can be raised against it from the human standpoint. If, however, it is used to, eliminate all but the very best workers, the

effect would be disastrous both from the human and from the economic standpoint until an entire readjustment of the field has been taken place. What is needed is a scheme whereby every man can be worked up to his full efficiency whether or not his output be as great as that of his neighbor.

Secondly the worker may object to these new methods because of his inherent inertia. The workman who has once learned and long practiced certain methods of doing work is seldom willing to admit that better ways may be devised if these ways appear to be radically different from those to which he is accustomed.

And lastly, he naturally oppose these new methods because his own experience and his inherited point of view naturally lead him to suspect any new methods that promise increased remuneration for increased efforts.

The first two objections may, perhaps, be removed by educational methods, but the third is deep rooted and involves principles that even the advocates of the new methods have not always fully appreciated. The basis of this objection is distrust, and the root of distrust is usually selfishness, sometimes on the part of the employee but more often on the part of the employer and this can be removed only when the employer and employee can agree as to what is a just and equitable division of the gains of industry which involves, not the application of scientific methods to human relations, but the application of the fair deal on the part of all concerned.

Just what changes shall be made in our political and social structure to make this fair distribution possible does not at present seem clear, and prophecies are useless. It is an open question as to whether or not the compulsory bargaining as determined by legislation will accomplish the desired results. One thing is clear, however; such changes are impending and impending not only because of unrest among workers of the lower grades but because of the changed point of view among the people at large. The situation is perfectly logical. It would be incredible that any intelligent nation, with high educational standards, should not arrive at the solution of the division of the gains of industry that will be fair and just and then compell all men to abide thereby. Laborsaving management, without doubt, will be much used ultimately because economic principles are valuable. But labor-saving management will have to justify every one of its feature much more fully than did its prototype, laborsaving machinery. It will not be enough that it will increase profits; it must justify its place in our social economy. Yet the need of improved methods both in our production processes and in our machinery of distribution is urgent, and the problem of securing these advantages without violent adjustment that cause suffering is not always an easy one. Fortunate, indeed, will it be if some of the reactive influences now at work on social and industrial organization point a peaceful way to this much needed readjustment. Certain is, however, that no great progress in this direction will be made till workmen are willing to learn forbearance and restrain from their excessive demands, and the employers, setting aside selfish advantages, will recognize mutual interest of all concerned in the benefit arising from increased production.