METHODS-TIME MEASUREMENT

Maynard, Stegemerten & Schwab

INDUSTRIAL ORGANIZATION AND MANAGEMENT SERIES

METHODS-TIME MEASUREMENT

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PREFACE

For many years management has felt the need for a procedure for establishing production standards that would eliminate the element of judgment on the part of the methods engineer. When a time study is made under the conventional time-study procedure, it is necessary for the observer to form a judgment of how the performance of the operator compares with the average or normal performance level. Regardless of the fact that such judgments can be made quite accurately by the experienced observer, because the intangible element of judgment is involved, it is difficult to prove that a correct determination has been made. There is often a tendency on the part of the worker to question the accuracy of standards determined in this manner, particularly if industrial relations are strained, and management has no way of proving the rightness of its production requirements except by studying and restudying the job until an overwhelming mass of evidence has been gathered.

This is costly and time consuming. Therefore, a procedure that eliminates the element of judgment will not only be more acceptable to labor, but it will be more economical to apply.

The methods-time measurement procedure eliminates the necessity for judging the performance level at which an operator works while being observed. The procedure is simply one of determining the motions required to perform the operation and then of assigning predetermined time standards to each limiting motion. The sum of the motion times gives the production standard for the job. True, a certain amount of judgment is required to determine what motions are necessary to perform the operation, but when the observer has an intimate knowledge of the work he is studying, this poses no particular problem. There is no judgment required insofar as the element of time is concerned, for the time standards used in the methods-time measurement have been predetermined as the result of lengthy research and investigation and are always the same for each set of motions.

The methods-time measurement procedure was originally developed as a means of methods improvement, and it is very effective when used

for this purpose. Because of the constant strain on industrial relations which is caused by the element of judgment in the work measurement process, however, management is likely to find that the improvement in industrial relations that is brought about by the use of the methods-time measurement procedure is just as valuable as the improvement in methods which inevitably follows its application.

The methods-time measurement procedure is deceptively easy to apply, and a word of warning, which is repeated frequently throughout the book, is in order. The procedure will give accurate results only if it is properly applied. Proper application requires not only a thorough understanding of the procedure itself, but also a thorough understanding of the motions used to perform the work under study. When the procedure is applied away from the workplace, it is quite easy to assume that the work is performed in a certain way. Subsequent checking by observation at the workplace will sometimes reveal that it is being done in quite a different way. Until a job or a class of work has been closely studied motion by motion, it is dangerous for the observer to assume that he knows how it is done.

The answer to most methods improvement and work measurement problems will be found in the methods-time measurement procedure if it is properly applied. It would be unfortunate to have a procedure as useful as this discredited, even only occasionally, by careless or inexpert attempts to apply it. It is hoped, therefore, that methods engineers will not attempt to apply the procedure, at least for the purpose of establishing production standards, until they are certain, as the result of study, experiment, and careful checking of results, that they can apply it correctly.

THE AUTHORS

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PART I

INTRODUCTION

CHAPTER 1

METHODS ENGINEERING

Since the dawn of reason, mankind has been looking for better and easier ways of performing the work that is necessary to support life and to increase material well-being. It has been recognized by the clear thinkers of all generations that in order to have, society as a group must produce. If more is to be had by the members of the group, then more must be produced. If greater leisure is desired in addition, then the goods must be turned out in less time. The capitalistic system has survived in spite of its obvious shortcomings because in the long run it has provided a higher standard of living for less work than any other system yet devised.

The capitalistic system itself does not produce. It merely provides the conditions and the incentives that cause large numbers of people to devote their time and their energies to production. Perhaps in the future some other system will be developed that will offer even stronger inducements for production. If so, mankind will be the gainer insofar as material well-being is concerned, for production is the sole basis for material prosperity. In the meantime, in the United States of America, at least, the rewards offered by the capitalistic system continue to stimulate many people to seek to produce as much as they can.

INDUSTRY'S SEARCH FOR BETTER MANUFACTURING METHODS

Since its earliest beginnings, industry has been more or less interested in better and more economical manufacturing methods. Interest is usually strongest when profits are low or nonexistent and when competition is severe. When profits are high, there is often a tendency to be satisfied with conditions as they are and a reluctance to do anything that might disturb the situation. The forces of competition, however, do not permit this to continue for long. Even the strongest and most self-satisfied company finds that it cannot neglect methods improvement indefinitely, for its competitors who do seek improvements will soon find it possible to lower prices and to take business away from it. Industries are turning

more and more to methods engineering in their search for ever better manufacturing methods.

FIG. 1.— Frederick W. Taylor.

HISTORY AND DEVELOPMENT OF METHODS ENGINEERING

The foundations for modern methods engineering were laid by Dr. Frederick W. Taylor, the father of scientific management, and by Frank B. and Lillian M. Gilbreth, pioneers in the field of motion study.

In 1885, Frederick W. Taylor was made foreman of a department of the Midvale Steel Company, situated just outside of Philadelphia. As

FIG. 2.— Frank B. and Lillian M. Gilbreth (about 1912).

foreman, he was held responsible for the quantity of production turned out by his department. From the outset, he was keenly aware of the fact that his men were by no means producing as much as they easily could. This appealed to him as being an economic waste, for Taylor saw clearly that production was the foundation for material prosperity. He there-

fore set himself the task of doing whatever was necessary to increase the productivity of his department.

After trying various procedures and carefully noting the results, Taylor at length evolved a simple principle that forms the basis for the operation of modern industry. It was, "The greatest production results when each worker is given a definite task to be performed in a definite time and in a definite manner." The definite task was prescribed by management in the form of a job description. At first the definite time was established from records of past performance, but later, when these records proved unreliable, it was determined by the stop-watch time-study procedure that Taylor developed. The definite manner was determined by management, and was issued to the worker in the form of an instruction card.

In order to make his principle operate most effectively, Taylor found it necessary to introduce a system of paying substantial rewards for the accomplishment of the tasks that he established as the result of his studies. Thus he introduced several types of wage incentive plans into industry.

Taylor never failed to stress the importance of method in all his writings on the subject of time and motion study. The production increases that resulted from the introduction of wage incentives based on stop-watch time study were so spectacular, however, that many of those who later tried to use his procedures tended to neglect a consideration of the factor of method. It required the efforts of another pioneer to emphasize the importance of developing the best working methods before proceeding with time study and wage incentives.

A few years after Taylor began his work on the development of scientific management, a building contractor named Frank Gilbreth decided to leave the field in which he had been eminently successful and to devote his time to the study of a subject which had for a long time held his interest. The story of Gilbreth's discovery on his first day as a bricklayer's apprentice of the number of different methods used by bricklayers in the simple task of laying a brick has often been told. His interest in this discovery never lagged, and finally, with the encouragement of his wife, Lillian M. Gilbreth, he decided to give up a profitable business and devote himself to the installation of scientific management, and especially to research and application work in the field of motion study. The Gilbreths began making detailed laboratory studies of motions and methods and at length developed the micromotion study procedure that forms the basis for much of what is to follow in this book.

Both Taylor and Gilbreth won many followers in the fields in which they pioneered. Some of these followers professed to see fundamental

differences in the procedures developed by these two men, and at length two groups of practitioners developed. One was the time-study group, and the other was the motion-study group. From roughly 1910 to 1930, these groups considered themselves as irrevocably opposed to each other. The time-study group could see nothing practical in the laboratory approach, and the motion-study group felt that the time-study group were unscientific and crude in their work.

At length, however, both groups began to become better acquainted with one another's work, and as is so often the case during the development stage of a new profession, began to realize that they had been calling the same things by different names. The differences were dropped, and the best features of both procedures were combined into a single, universally applicable procedure now widely known as "methods engineering."

DEFINITION OF METHODS ENGINEERING

The methods-engineering procedure integrates all of the practical devices that have been developed to bring about increased productivity into one unified procedure. Since it includes several procedures, its definition must of necessity be long.

> Methods engineering is the technique that subjects each operation of a given piece of work to close analysis in order to eliminate every unnecessary operation and in order to approach the quickest and best method of performing each necessary operation; it includes the standardization of equipment, methods, and working conditions; it trains the operator to follow the standard method; when all this has been done, and not before, it determines by accurate measurement the number of standard hours in which an operator working with standard performance can do the job; finally, it usually, although not necessarily, devises a plan for compensating labor which encourages the operator to attain or to surpass standard performance.[1]

The definition definitely states that the method should be developed, standardized, and taught to the operator before the time for performing the task is measured. In theory, this is correct, and certainly the chronological order cannot be questioned. In practice, however, it has not been possible to keep methods study and time study completely separated, nor can they always be made in the theoretically correct order. Many

[1] MAYNARD, H. B., and G. J. STEGEMERTEN, "Operation Analysis," Chap. I, McGraw-Hill Book Company, Inc., 1939.

methods improvements are discovered in practice during the making of a time study. A decision as to which is the better of two or more contemplated methods cannot be made in some cases until the methods have been timed.

This difficulty, which has bothered methods engineers for years, is due to the limitations of procedures which consider methods and time separately. In reality they are inseparable. The method determines the time, and the time establishes which is the best method. It is felt that the methods-time measurement procedure which is the subject of this book and which considers method and time simultaneously solves the difficulty in cases where it is applicable.

THE GROWING EMPHASIS ON BETTER METHODS

As industry matures in any country, the opportunities for obtaining competitive advantage tend to diminish. Many factors become stabilized and uniform. Competing designs, for example, which may be radically different when a product has been newly invented, tend to become much the same as patents expire and each competitor incorporates the best design features of all the others into his product.

The possibilities for obtaining a favorable "buy" of a given material diminish as markets become developed and stable. Low wages are no longer considered as a likely source of competitive advantage. With wages tending to become more nearly the same as the result of widespread collective bargaining, this important item of cost tends to become uniform insofar as base rates are concerned.

There is one area, however, in which competitive advantage may be sought almost indefinitely, and that is in the area of better manufacturing methods. The methods engineer has demonstrated repeatedly that the method of performing a given operation can be improved again and again, if the repetitiveness justifies it, as fresh study and analysis are applied to it. Therefore, better methods are an ever-present possibility. They offer the best source of competitive advantage that exists in American industry.

PROBLEMS ARISING FROM METHODS CHANGES

It has often been said that nothing is certain but change. It has also been remarked repeatedly that it is human nature to resent change. A certain amount of change is inevitable in industry and is to be endured because its effect in the long run is beneficial. There is a large classification of change, however, which is not necessary or which, at least, can