

tent still is; seconds are very rarely used except in scientific research. Now in the scientific development of business and manufacturing methods, more precise measurement of time also becomes necessary, and we have the time study, in which the minute is divided into hundredths. In some cases, work with the micro-motion camera necessitates its division into thousandths or even more minute proportions.

Although time study is a most important element in the development of scientific management, it should always be borne in mind that it is by no means the beginning. As a matter of fact, it would be impossible in the average organization to develop a standard on any particular operation without previously standardizing other conditions which bear on the particular operation in question. It is this preliminary work—the prestandardization stage, as I term it—that should in every case be performed before time study is resorted to in the development of specific operation standards. In this prestandardization stage the crudest forms of measurement often become most important methods of analysis.

Thus, I have developed and extensively used one form of measurement by which I am enabled very quickly to determine the relative efficiency of any office organization. It is a method which has been applied very extensively to merchandising or manufacturing companies where most of the office work revolves around the order. The same plan can be applied to other types of organization where some other unit, not an order, is used. For example, in a department store the credit sales transaction can be used as a unit, as much of the clerical work revolves around it. In such concerns the volume of work is influenced either directly or indirectly by the volume of orders, as I mentioned before. The first step is to take the total number of persons working, either directly or indirectly, on the order. This will, for example, eliminate the clerks in the sales promotion and costs departments. The former are, of course, engaged in work which may result in future orders, while the activities of the latter are connected with production rather than with the handling of orders. The number of clerks working upon orders is multiplied by the number of minutes in the average working day, a calculation which gives the total number of clerical minutes. This figure is then divided by the average

number of orders handled in one day. This average should be taken over a period of six months or more. The figure found by this division will be the clerical minutes per order. This process has been worked out in literally hundreds of offices. The average number of minutes per order varies from thirty to 1280. The latter figure was found in the office of one of the largest corporations in the country. This very crude form of measurement settles immediately the question of the general effectiveness of the office in handling orders.

The next step is to determine, with an equally crude form of measurement, the amount of time that is occupied on each of the operations in the routine. It is very seldom, indeed, that the total of the net time of these operations is more than one-half of the gross time. The difference is loss in efficiency due to faulty organization. If the same method is used to measure the effectiveness of departments, it can be very quickly determined which of them stands in most need of improvement.

This brings up another point. In these days we hear a lot about hand-to-mouth buying, and I should like to remind you that when you change one element, or one factor, of a problem you change the whole problem. As an illustration, and I think it a particularly appropriate illustration since we are meeting in Detroit, when the horseless carriage was invented they placed a motor in a carriage and everybody, even the inventor, thought that the only change that had been made was the omission of the horse. We know today, however, that the omission of the horse changed everything, even you and me. It changed our whole method of doing business, changed our customs and manners, and probably changed even our destiny. A lot of people have denounced hand-to-mouth buying as a terrible thing. The people who denounce it are the people who have to furnish the goods to those people who order in unequal quantities, and I admit there is a great deal to be said against the ridiculously small order.

I ran across a case the other day where fifty-five per cent of the orders of a company doing a business of \$12,000 a year are less than \$10 each, and thirty-five per cent of them are less than \$5 each. This company is not handling wholesale orders as they think they are; they are handling less than retail orders. Mr. Everitt, President of Montgomery, Ward and Company, made the state-

ment to me that their average retail order was \$7.50, and yet this company is selling to retailers orders for \$5. Inasmuch as it costs them \$2 apiece to handle each one of these orders, you can understand how much profit they are making on fifty-five per cent of their orders.

Here is an example of a company operating on the old basis and thinking that it has only omitted the horse. They have an entirely new condition, however, and if they want to handle the situation they must have an entirely new order system. They must omit a lot of the unnecessary things they are doing at the present time.

Another equally crude measurement which I have often used to determine the flow of work through an organization is to attach to a group of ten orders a simple record upon which the worker on each operation in the routine notes the time he received the order and the time he finished with it. I have invariably found that this special batch of orders will travel through the routine much more quickly than will the average order, not so identified, which is, of course, to be expected. The results, however, are checked by initialing another batch of orders, without the knowledge of the employees through whose hands it passes, and sending it through the routine at the same time, carefully noting the time it started and the time the last operation was finished. The difference between these two will show whether or not the work flows smoothly.

Both of these methods appear crude as compared with the accuracy and precision of a time study, but they are nevertheless sufficiently accurate for the purpose and develop many important facts in the prestandardization period.

As another means of measurement I ask each section head to list the various operations regularly performed in his section, and to obtain an average time on each operation by recording the time on one hundred pieces. There is always a tendency on the part of the section head to overestimate this time, or at least to be exceptionally liberal in taking the records. Nevertheless, the information gained through this simple average time record is of extreme importance in improving the control of a department. This method also possesses a psychological advantage. Since it is performed by the section head it is not likely to be disputed by him.

This average time is termed production time, and the total number of pieces done in one hour on this average time is called a production unit, to distinguish it from the standard unit of work obtained by a scientific time study. A weekly report is then made to the department manager on which the total number of available minutes is obtained by multiplying the number of employees by the number of minutes they work. The total production units, expressed in minutes, is obtained by multiplying the production unit by the number of pieces handled. The number of these production units is then deducted from the total available time. The remainder, usually expressed in minutes, is converted into hours, which are termed lost hours. It is made very clear to the section head that the management desires a minimum of these lost hours, but that in office work it is never possible to eliminate them entirely.

I should like to explain that in the factory you can determine how many pieces you are going to put through each day, and as nearly as possible try to live up to your plan, but in office work the volume of the work is largely controlled by people on the outside. It is beyond your control. On Monday you have a big day; on Tuesday you have a light one, and so on.

The results of this measurement are frequently so startling that the section head immediately starts to improve the handling of the work so as to eliminate, as far as possible, the lost hours. If the initiative does not come from him, it is almost certain to come from the department manager, who does not like to have recorded, week after week, a large and unexplained number of lost hours in his department.

I mention these simpler forms of measurement to emphasize the importance of breaking down every management problem into its elements before beginning the precise measurement involved in time study. No intelligent person would begin the investigation of a social question in a large city by interviewing every inhabitant of that city in a door-to-door canvass. Such an investigation would require far more time and yield far less usable information than would an investigation which started out with a definition of its purpose and a thorough analysis of the problem, before any work was done. The city would then be divided into industrial or residential groups, and a