pose of rate fixing, is only beginning to be recognized.[5] Mention has been made of this broader use as it relates to managerial control, although the treatment thus far has chiefly considered the operation of time and motion study in the determination of the standards themselves. The setting of incentives is only one of the uses for exact time standards; of equal importance are other uses in planning production so that manufacturing schedules will really fit the factory force and equipment, in determining the proper number of employes for given schedules, in evaluating quality, in developing best methods of operating and in determining labor costs to use in fixing sales prices. It is in its relation to these features as well as in its use for fixing accurate incentives that the value of time study is evident in smoothing the wrinkles from management.

The lack of appreciation, even in otherwise well regulated shops, of the time element in planning and scheduling is astounding. In our contact with various plants throughout the country, we find that most of them have certain elements of what is essentially "scientific management," although many would scorn to designate it by that term. We find, for example, that many of the up-to-date shops, and especially the larger ones, have the materials well under control with running inventories substantially identical with the "balance of stores" originated by Taylor; we find the fundamental principles of planning the work; we find manufacturing orders made out in fair shape and a certain amount of planned control in most of these plants. Yet in case after case there is the serious lack of this "time" element in planning. In other words, in making out a manufacturing schedule there is practically no study made to see whether the time capacity of all important machines and men is equal to the task required.

This disregard of the time element produces a lack of co-ordination, which in turn causes many of the troubles which result in congestion in certain departments or work places with famine in others, in the excess or deficiency of employes on different operations, in unnecessary time in process and in a consequent failure to make deliveries on schedule time. Idle time of machines or of operatives either from waiting or from slowing up the work is inevitable. This means also an increase in unit costs of production.

To overcome this delay and lost time, which is particularly noticeable in plants making complicated lines of products, the time element must be an important feature in the planning of the work. Actual examples best illustrate its importance.

Case 1. Let us take the forge shop of a plant manufacturing large complicated machinery of many styles and types. Its specifications were well laid out; its materials were under good control, but the varieties of the different parts raised havoc in meeting schedules. In working on a certain schedule, for example, designed for completion in a single month, it was found that, while it was all right on the average, there was sufficient work laid out for one particular type of equipment to keep it busy forty working days out of the possible twenty-five. In other words, the carrying out of the schedule was a physical impossibility. This situation was entirely cured by utilizing the actual times of performing the operations in making up the manufacturing schedule.

Case 2. In another shop, the machines scheduled to be made during the first half of the month left the "eye benders" with very little work, then required twice the capacity of this equipment for the balance of the month. There was only one possible result, namely, delay in getting out the work on time, plus the natural resentment of the eye benders who were obliged to lose time the first part of the month and then were driven during the last half in a vain attempt to accomplish the impossible. Employes consider this pretty rotten management, and it *is* "rotten management."

Case 3. In a certain shoe shop (in fact, this is generally customary) the orders were put into production as so many pairs per day, regardless of the time required on the different styles. It was found that one style required for the operation of fancy stitching thirty-five times as long a time as a certain other style, and intermediate styles varied all the way between these extremes. The result was a feast and famine situation. At one time, for example, there were forty fancy stitchers. They had only enough work to keep twenty of them busy one week, while the next week, with the same number of pairs of shoes scheduled, there was enough work for sixty fancy stitchers. No wonder the operators think the management does not know its business!

[5] For a practical treatment of production control see William O. Lichtner, "Planned Control," The Ronald Press, New York, 1921.

Co-ordinating Operatives and Production

The means of correcting such situations as this, which are all too common, is through the use of time standards in planning schedules.

In the tables which follow are illustrated the manner in practical operation of adjusting, on the one hand, the schedules to the number of operatives available and, on the other hand, of determining in advance the number of operatives required.

The two schedules which follow show the number of operatives required for each operation in a garment factory for different combinations of orders.

PLANNING SHEET FOR ESTABLISHING PROPER NUMBER OF EMPLOYES BY CLASSES FOR WEEKLY PRODUCTION SCHEDULES (SCHEDULE No. 1)

Operators per 100 = Number of operators required to turn out 100 garments in a 44 hour week
Quantity scheduled = Number of garments (in hundreds) scheduled for the week
Total operators = Quantity scheduled multiplied by "Operators per 100"

Style of Garment	Quantity scheduled (in hundreds)	Operations: Seaming		Facing		Sleeve making		Finishing		Button-holing		Towels & Aprons	
		Oper. per 100 coats	Total oper.	Oper. per 100 coats	Total oper.	Oper. per 100 coats	Total oper.	Oper. per 100 coats	Total oper.	Oper. per 100 coats	Total oper.	Oper. per 100 coats	Total oper.
Coats													
No. 1 Coat	4.32	0.101	0.44	0.292	1.26	0.264	1.14	0.225	0.97	0.056	0.24		
No. 3 Coat		0.109		0.196		0.264		0.226		0.051			
No. 4 Coat		0.111		0.193		0.264		0.226		0.051			
No. 6 Coat	8.64	0.123	1.06	0.236	2.04	0.264	2.20	0.226	1.95	0.063	0.55		
No. 8 Coat	4.32	0.113	0.49	0.244	1.05	0.264	1.14	0.226	0.98	0.037	0.16		
No. 9 Coat	43.20	0.119	5.14	0.237	9.82	0.264	11.40	0.226	9.75	0.051	2.21		
No. 11 Coat	43.20	0.111	4.80	0.193	8.35	0.264	11.40	0.226	9.75	0.051	2.21		
No. 12 Coat		0.150		0.376									
Aprons													
No. 1 Apron	10.80											0.059	0.63
No. 3 Apron												0.057	
No. 5 Apron												0.079	
No. 6 Apron	24.00											0.072	1.73
No. 6L Apron	14.40											0.072	1.04
No. 11 Apron	24.00											0.078	1.87
Bungalow Apron	6.00											0.458	2.75
Towels	120.00											0.010	1.20
Total Operators Required			11.93		22.52		27.36		23.40		5.37		9.22

The first column gives the different styles of coats and aprons and the second column the quantity scheduled in hundreds.

The third column gives the number of operatives required per day for the operation of seaming one hundred coats. For example, for one hundred No. 1 coats one-tenth of an operative is needed, while the total number of operatives for the scheduled quantity of eighteen hundred is 1.82, or two operatives. The other columns are carried out similarly for the other operations.

By adding the items the total number of operators required to carry out the schedule is found.

These tables are expressed graphically in the accompanying charts. In Schedule 1 (Figure 3), for example, from the black lines representing the number of operatives, we see that in seaming ten operators were required, while in Schedule 2 (Figure 4) five were required. Similar differences are noted in other operations. The apron and towel operators are given with the others because the same operators make aprons and towels, as well as coats.

Comparing the two schedules, it is evident that with a constant number of employes there is necessarily a great deal of lost time. In this particular shop, before adjustment, the working time averaged twenty to twenty-five per cent below normal. By