

I regret that this is not confined to two pages. In trying to make the thing intelligible I have run to ten. I hope, however, that I have furnished your friend a foundation on which to build a revision of his estimate of the Waste-in-Industry Report.

## APPENDIX A

Expression of the Data in the charts, p. 109, Waste in Industry, in the Form of Hourly Production Rates, Efficiency of Operation, Efficiency of Method and Efficiency of Application.

Stand- ard No.	Stand- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.	St- and- ard No.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
223	1255	226	50	28	50	2095	1435	94	48	40	2	5	5	5	5	5	5	5	5	5

## APPENDIX B

## METHOD OF MEASURING OPERATING EFFICIENCY

This can be brought out best by an illustration. In one of my jobs I determined by careful elementary and overall time studies that with a Union Special Overlock Stitch sewing machine, maintained in a certain specified adjustment, cleaned and oiled three times per ten hours, speeded at 2,825 stitches per minute and making twenty-four stitches per inch, with a certain specified width, depth and height of machine table and of work holder, with certain specified thickness and tensile strength of thread, furnished on cones of a certain specified yardage and with the skilled use of a certain minutely specified method of feeding in, guiding and handling a handkerchief, 10.1 hours was the shortest time in which a skilled operative could be expected to hemstitch one hundred dozen twelve inch by twelve inch handkerchiefs; the corresponding standard time for one hundred dozen nine inch by nine inch handkerchiefs was 7.8 hours, and so on. A certain mathematical formula gave the standard time for any number of handkerchiefs of any dimensions.

If now an operative stitches one hundred dozen twelve inch by twelve inch handkerchiefs in exactly 10.1 hours, obviously she has come up to standard or is one hundred per cent efficient on that one assignment. However, if she takes 11.2 hours then she has delivered only 10.1/11.2 or ninety per cent of the standard amount of work in that time; she is only ninety per cent efficient on that one assignment; there is a waste of ten per cent of the capacity of this operative together with her equipment and work-space.

Now suppose that during a given week of fifty-four hours, this operative completes six "jobs" on which the standard time and the consumed time are as follows:

	Standard Time	Time Taken
1st .....	10.1 hrs.	11.2 hrs.
2nd .....	10.1 "	10.1 "
3rd .....	9.7 "	10.0 "
4th .....	9.7 "	9.7 "
5th .....	7.8 "	7.8 "
6th .....	7.8 "	7.8 "
Total.....	55.2 "	56.6 "

Then in 56.6 actual work hours she has delivered 55.2 standard hours of work. The quotient, 55.2 ÷ 56.6, is 0.975 or 97.5 per cent. Her average efficiency on these six completed jobs is 97.5 per cent.

One of these jobs was evidently commenced Friday or Saturday of the preceding week, thus accounting for 56.6 hours on jobs finished in a fifty-four hour week.

Observe that this operative has not been confined to twelve inch by twelve inch handkerchiefs. Yet by stating every job in terms of two aspects, (1) standard time, (2) time taken, we have reduced these jobs of somewhat varying character to a common denominator, are able to add them and measure the operative's average efficiency. As a matter of fact these six jobs need not all be hemstitching; some might have been folding, some ribboning, yet we could have measured the operative's average efficiency for the week on this basis of completed jobs.

Let us enlarge our view to take in ten hemstitchers. Their records on jobs completed during this week are as follows:

Operative	Total Standard Time	Total Time Taken	Individual Efficiency Per Cent
A .....	52.8 hrs.	52.8 hrs.	100
B .....	53.5 "	53.5 "	100
C .....	54.0 "	55.5 "	99
D .....	55.2 "	56.6 "	97.5
E .....	54.3 "	55.8 "	97.4
F .....	52.0 "	53.9 "	96.5
G .....	50. "	53.4 "	93.6
H .....	48.7 "	52.7 "	92.4
I .....	48.0 "	53.1 "	90.4
K .....	22.8 "	25.7 "	88.0
Total...	491.8 "	513.2 "	96.0 Ave.

Here the ten operatives have delivered 491.8 standard hours of work in 513.2 actual hours or ninety-six per cent. Thus while individual efficiency ranges from one hundred per cent down to eighty-eight per cent, we are able to combine them into an average efficiency for the group. The same process could be applied to a whole department. Observe also that operative K has been working for only a part of the week, yet we measure the average group efficiency.

Suppose that the totals for the various departments for the given week are as follows:

Dept.	Total Standard Time	Total Time Taken	Average Efficiency Per Cent
Hemstitch .....	4,918 hrs.	5,132 hrs.	96
Embroidery .....	7,500 "	7,648 "	98
Ironing .....	564 "	594 "	95
Folding .....	3,500 "	3,725 "	94
Ribboning .....	2,350 "	2,375 "	99
Box Making.....	1,013 "	1,350 "	75
	19,845 "	20,824 "	95.3 Ave.

Here the operatives of six different departments have together delivered 19,845 standard hours of work in 20,824 actual hours or 95.3 per cent of the standard. The work of the six departments is all different. Yet we measure the average efficiency of all the operatives of the factory.

If any person objects to adding an hour of hemstitching to hour of box making or of embroidering on the ground that they are of different values, he can still measure the average efficiency of all operatives by converting both the standard time and the time taken in each department into their values. For most persons, however, the hour-comparison will be fully satisfying.

The above merely measures the efficiency of operatives. Time lost through machine breakdowns, being out of work and the like is recorded on separate "wait-time" cards.

In the above illustration workplaces have also worked 20,824 hours. Suppose that the factory contains 460 workplaces.

If each of these were in operation the full fifty hours (as recorded on operative's time cards for jobs) their total would be 24,840 workplace hours. Only 20,824 are accounted for in productive work. Utilization of workplace capacity has been

only eighty per cent. With suitable records this can be allocated to breakdowns, running out of work, absenteeism, shop meetings, stoppages, accidents, labor turnover, labor shortage and the like.

If only eighty per cent of workplace time is used and the use of that eighty per cent is only 95.3 per cent efficiency, evidently the efficiency of operation of the whole factory is only 95.3 per cent of eighty per cent or 76.24 per cent.

## APPENDIX C

## WORKING SHEET MAKING PASSAGE FROM MAXIMUM WASTE FACTORS TO "ASSIGNED POINTS"

Waste Factor	Pre- line Assigned Points*	Assigned Points*	Waste Factor	Pre- line Assigned Points*	Assigned Points*	Waste Factor	Pre- line Assigned Points*	Assigned Points*
1	1.1	0.46	0.5	1.1	0.5	1.35	1.5	0.1
2	7.0	3.16	0.1	2	0.0	2.31	2.2	0.19
3	2.0	0.89	0.9	3	0.7	0.85	0.3	0.44
4	2.9	1.20	1.0	4	0.9	0.45	4.4	0.20
5	0.0	2.31	2.3	5	0.0	3.90	4.0	5.0
6	0.7	0.27	0.3	6	0.0	0.89	0.9	6.1
7	14.9	6.64	6.6	7	10.9	0.16	8.2	7.0
7-1/2	16.0	7.00	7.1	8	10.0	7.06	7.1	0.9
7-2/3	6.1	2.66	2.7	8-1/2	23.43	23.4	9	0.7
8	0.0	0.0	0.0	10	0.0	0.0	10	0.0
9	0.0	0.0	0.0	11	3.4	1.55	1.5	0.0
10	2.0	0.89	0.9	12	9.0	3.90	4.0	0.0
11	0.7	0.27	0.3	13	2.0	0.89	0.9	0.0
12	0.7	0.27	0.3	14	5.0	2.31	2.2	0.0
13	9.3	4.43	4.4	15	1.4	0.46	0.7	0.0
14	2.0	0.89	0.9	16	3.4	1.55	1.6	0.0
15	2.0	0.89	0.9	17	0.8	0.44	0.4	0.0
16	0.9	0.46	0.4	18	0.8	0.44	0.4	0.0
17	0.9	0.46	0.4	19	2.5	1.11	1.2	0.0
18	0.9	0.46	0.4	20	0.8	0.44	0.4	0.0
19	2.5	1.11	1.2	21	0.0	0.89	0.9	0.0
20	0.9	0.46	0.4	22	0.0	0.89	0.9	0.0
21	2.0	0.89	0.9	23	0.0	0.89	0.9	0.0
22	0.0	0.0	0.0	24	0.0	0.0	0.0	0.0
Total	60.2	25.68	25.6					

## APPENDIX D

## OBSERVATIONS OF A PROMINENT EXECUTIVE IN REPLY TO THE ABOVE CRITICISM

The Report "Waste in Industry" is undoubtedly the result of an extremely thorough and careful analysis of the conditions found in the establishments taken as representative of the various trades investigated.

Whether or not the picture is overdrawn must, of course, depend on the particular examples chosen. Until we have a larger percentage of all industries represented, doubt will probably exist and give rise to argument as to the absolute truthfulness of the tabulated results, as applying to all industries considered collectively.

Such doubt, however, need not detract from the usefulness of the report as a basis of bettering the conditions in our industrial establishments.

I do not find anywhere a condition which could possibly be doubted as existing. The only doubt that might arise would come rather as to the degree in which the wastes outlined might exist in industry as a whole.

Every concern probably has its long suit. One may be exceptionally good on stores control, another on personnel, another on planning and so on, but I have yet to see any concern that can assay 100 per cent on all subjects and most concerns are probably well below such a figure.

We all recognize that management alone cannot prevent all wastes. Some are distinctly within the control of the workers themselves. No one can refute this statement. The management can set limits as to allowed wastages but the ability of individuals varies tremendously and such limits would of necessity be more liberal than absolutely necessary.

The temperment of the workers will assert itself more or less and be reflected in wastes of all kinds, such as waste of time on the job, waste of material, wastes due to the workers' desire for recreation, pleasure, etc., and to lack of full application while on the job.

It is a difficult matter to accurately set down the definite ratio of management responsibility to workers' responsibility.

The statement that management is responsible for seventy-five per cent and labor for twenty-five per cent may look like a rather cold statement of fact which cannot be backed up. Perhaps it cannot, in cold figures. But why worry about that? We all realize it is a divided responsibility and we must surely get some idea as to the ratio between management and labor in order to intelligently effect betterments.

Does any one criticize time study methods whereby we tabulate time in less than seconds? Most time study men work in hundredths of a minute or only three-fifths of a second.

This precision carries us to two places of decimal in discussing one short minute as applied to productive effort. Why should anyone criticize similar tactics in attempting an analysis of Wastes in Industry?

Whenever we attempt to separate a problem into a multitude of component parts we must of necessity endeavor to rate as accurately as possible each of these parts when considered separately.

Whenever we deal with more or less intangible things we must always expect a certain element of inaccuracy, but we would multiply, rather than reduce such percentage if we relaxed on our endeavor to rate our separate findings as accurately as possible.

We must always bear in mind that many things perfectly attainable, may cost more in money or effort than they are worth after we get them. The old law of diminishing returns is ever