

others, and that like a three-legged stool, no leg could be shortened or extended in length without tilting the stool or tipping it over entirely. Another viewpoint was that fifty of the one hundred points should be considered as the utilization value, on the theory that the greatest of the three factors is the way organization and technical knowledge are manipulated to useful purposes by those responsible for the administration of a business.

The language of the instructions accompanying the evaluation sheet—"determine according to judgment and impressions from investigation"—may be criticised on the score that if we enter the realm of reason and mental debate, we leave that of fact and definiteness. I am not so sure that this is so. Obviously, you would not go to a horse doctor for a medical examination, or to a contractor to remove a tooth, just because he does excavating. Likewise, you would not trust an industrial survey to a lawyer or a preacher. A competent engineer with a knowledge of the industry and plant being studied should, however, be able to say whether a given thing was "bad" or "excellent," as the two extremes. If he could not call it "bad" or "excellent," he could say whether it approached or approximated one for the other of these extremes, or "poor" or "good." If one of these should not satisfy him he could use a compromise or mean as the value, calling it "fair."

I am perfectly willing to admit that there are difficulties in the way of breaking down the total assigned points, Column 13, opposite each of the three causes, and apportioning them to management, labor and outside contacts. If a genius like Carl Barth, however, can take a dozen variables and reduce them to a slide rule, there is some justification for the belief, that competent engineers, like the ones who conducted the six assays for the Hoover Committee, can say whether responsibility classifies under one or more of the three divisions. If they know the industry, the nature of its problems, and the real meaning of the key questions, they can indicate, as to points at least, the division which seems proper.

On page 9 of the Report there is this statement: Over 50% of the responsibility for these wastes can be placed at the door of management and less than 25% at the door of labor; while the amount chargeable to outside contacts is least of all.

Whatever else may be said of the questionnaire and evaluation sheet, the fact remains that a quantitative conclusion, satisfactory to the engineering mind, was the definite result of the assays made, and in itself amply justifies the use of the mechanism developed.

For fear, however, that what has been presented may be looked upon as enthusiasm over a finished product of maximum effectiveness, let me say that like Mr. Cooke, I consider the questionnaire and evaluation sheet as used, *as only a beginning*. I say this fully appreciating the worth and value of this first real attempt on the part of engineers to give American industry a means for assaying waste, as to both cause and responsibility.

While wonderful progress has been made in the field of industrial or management engineering, the fact remains that due to a lack of proper terminology, an absence of definite units of measurement, and a lack of a uniform means for examination and evaluation, it has been necessary too many times to fall back on generalizations, opinions based on experience or reputation, indefinite conclusions and approximations. If progress to date is not all it should be, the lack can be charged to the failure to examine properly and evaluate definitely.

For this reason, it is my conviction that a much more rapid and efficient development of the art of management will begin from the moment a perfected mechanism for analysis and diagnosis is placed in the hands of our engineers. Especially is this so when it is considered that what was designed in so short a time, for rapid-fire use, was for *assay* purposes, and not for making *surveys*.

What has been done, however, will serve as an excellent foundation, and as an indication of future possibilities let me outline the following:

1. Additional studies will indicate other phases of industrial activities wherein wastes can occur, which should be included in the questionnaire.
2. More thought can be given to a better placement of questions under the proper cause of waste.
3. There can be a better arrangement of key questions, and subordinate questions under each cause, that the presentation may be more logical.
4. Greater care can be used in developing key questions, so that each may become a "leading" question in every sense of the word, and be so worded as to parallel the "hypothetical" question as used in legal procedure.
5. It would seem that there should be fewer key questions under *Organization* and *Utilization*, and more under *Technical*, perhaps ten under each, to facilitate an even pointing if desired. This would mean thirty key questions in all and would seem to be sufficient.
6. Conditions peculiar to a given industry can be met by dropping questions which do not apply, and add-

ing those which do apply, so long as the *class* of key questions, and not the key questions themselves, covers elements common to all industry.

7. The nature of questions can be further studied. You cannot ask a man if there are internal politics at work in his plant, and rely entirely on his answer, any more than the good wife can rely on the reply "hubby" gives her, when she asks if he is true to her. In other words, certain questions can be direct in character like—"When was the business incorporated?" Others must be indirect, as for instance—"Do workers have a voice in determining working hours and rules, to what extent, how and within what limits?" Others must be answered from impressions and further analysis, as "Are speeds and feeds up to best accepted practice?" There are also obvious questions and obscure questions. The question—"What idle time records are used?" is easily understood; while the question—"What type of mind (sales, financial, engineering or manufacturing) dominates the business?"—requires an explanation of what is meant by the four classes.

8. If no result is all waste, is an eighty per cent waste factor proper for a condition which can be characterized as "bad?"

9. Consideration should be given to the problem as to whether assignment of points according to causes should be left to judgment and impressions, or to a definite arrangement, as one-third to each, or fifty to *Utilization* and twenty-five each to *Organization* and *Technical Knowledge*, or some other basis.

10. Considerable thought should be given to the breakdown of points opposite each of the three causes, against management, labor and outside contacts. Should the points of possible waste vary within an industry, or should the variation be in the estimated waste factors? If the key questions represent major activities, or industrial factors and elements, cannot those under each cause be called 100 and a proper division made? For instance, let us consider that there are ten major elements in waste, each having ten points as follows:

Element	Management	Labor	Outside Contacts
1. Idle equipment and floor space	10	..	..
2. Faulty workmanship and defective material	..	5	5
3. Low production per hour	5	5	..
4. Too much work in process and unbalanced inventories	10	..	..
5. Too frequent changes in jobs	10	..	..
6. High labor turnover	5	5	..
7. Fatigue of workers	10	..	..
8. Untrained workers	5	5	..
9. Lack of standards	10	..	10
10. Periodic lack of orders	..	..	..
Total	65	20	15

If we had assigned points of possible waste against causes, as 40, 40 and 20, then we could multiply 65, 20 and 15 by 40, 40 and 20 and have:

Cause	Management	Labor	Outside Contacts	Total
Organization	26	8	6	40
Technical knowledge	26	8	6	40
Utilization	13	4	3	20
Totals	65	20	15	100

11. It would seem proper to retain the three divisions of cause and responsibility, although thought should be given to whether financing, or "capital" should be considered along with management, labor and outside contacts.

12. A way should be found whereby one industry can be compared with another. This could be brought about by attempting to reduce industrial activities to common elements, corresponding to the vertebrae in the human system.

13. Inasmuch as "best known practice" is considered standard, it is most important that the questions be most carefully developed so as to detect departure from standard in assaying the wastes, and to this end standard questionnaires according to industry might be well worth while.

14. Finally the matter of a "self-analysis" might well be considered. I am somewhat doubtful whether it can be done, for labor and management would be following best practice if they knew what it is and could introduce it. Any man, no matter who he is, who "doesn't know that he doesn't know," is bound to rate things higher than they should be rated, and this assay of waste in industry proved conclusively that on a "self analysis" basis entirely, waste and responsibility would have been evaluated at much less than the findings indicate. On the other hand, the task is not an impossible one, and if some of these avenues of further possibilities can be properly explored, the results might mean a plan of "self analysis" with corresponding evaluation which would be immensely valuable.

My presentation would not be complete without a few words regarding the application of the questionnaire and evaluation sheet to American industry. Concerns believe in having appraisals made, books audited, materials tested, mixtures analyzed, safety conditions inspected, equipment looked over periodically to anticipate wear and breakdowns, and operations subjected to more or less rigid process and final inspections. If these are important, how much more important is the matter of appraising, testing, analyzing and inspecting the management of an enterprise?