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Cost and Production Standards*

By WILLIAM B. CASTENHOLZ

Accountants, and especially cost accountants, very often speak of standards in connection with factory operations without clearly defining their language. The audience, or the reader, perhaps, is therefore at a loss to appreciate the conclusions that may be drawn from the discussion because there are two distinct standards and unless these are clearly defined there cannot be a meeting of minds between the message bearer and his audience. This fact was clearly demonstrated at the last annual convention of the National Association of Cost Accountants. The two standards referred to are cost standards and production standards.

COST STANDARDS

A cost standard in connection with any factory performance is based upon actual experience as evidenced by past records indicating normal conditions. If, for example, it is found that under normal conditions a machine has worked 2,600 hours a year in a plant working 9 hours a day for 300 days and the machine-hour-rate method is used for allocating factory overhead, then the standard hourly rate of overhead for that machine is the resultant obtained by dividing the annual factory overhead applicable by 2,600. In so doing consideration has been given to the 100 idle hours which must be viewed as unavoidable and normal in the light of the past experience. To a certain extent, therefore, we must lose sight of the 100 idle hours, because if we assume that the plant has operated normally we are confronted with an unalterable condition which predicates the determination of the machine-hour rate of factory overhead.

Again, if we find another machine that has operated only 2,000 hours a year under assumed normal conditions, we are forced to

* A paper read at the mid-west regional meeting of the American Institute of Accountants, Des Moines, Iowa, November 11, 1921.

use 2,000 hours as the divisor in determining that machine's hourly rate of overhead, because cost standards are based upon facts and experience gained during periods of normal production. By normal production and normal conditions we mean a state or a condition that has not been impeded by any unusual business situation and takes into consideration all existing limitations to production within the plant itself. This condition therefore fixes the entire cost standard, since it is assumed that a repetition of the past experience is about all that can be expected from the same factory facilities and operating conditions. Standard cost rates may therefore be defined as experience rates based upon the assumption of past normal conditions.

That past cost experiences are the best bases for the formulation of present cost standards is quite undeniable. Unless cost standards are constructed on such bases the cost figures will not register the true present status of factory operations but instead will reflect hypothetical cost. Costs at any and all times should portray the actual operating conditions of a plant even though these latter may be far from desirable. The fetish of an ideal cost is a production rather than a cost matter. A cost standard is therefore not necessarily representative of the lowest possible costs but expresses merely assumed normal experience results. We have expanded somewhat upon our definition of cost standards in order clearly to demarcate the latter from production standards. Production standards are based upon an operating ideal and therefore represent either capacity units or modified maxima.

USES OF COST STANDARDS

Cost standards or rather cost experience standards are used as yardsticks to measure present actual costs in order to determine whether the latter are falling above or below the assumed normal experience mark. It thus becomes possible to establish the quantities and values of materials that should be used in certain products. When material standards are set, it would, of course, be extremely faulty to fix on material values only because the prices of materials used may fluctuate widely. Consideration must certainly be given to the quantities first and these should not vary materially from the quantity-standard created.

Past experiences with reference to direct labor costs will fix the labor-cost standard, again bearing in mind, however, that the

standard is expressed primarily in hours of labor per given operation and not in values. The values will fluctuate with changes in labor rates. Variations in labor rates will be expressed in larger or smaller value costs even though the hours may be approximately the same. Such variations must naturally be checked up and the causes therefor determined. It may be that the labor force is improperly distributed with reference to skill requirements.

Factory overhead statistics for past years or periods of assumed normal production furnish the information with reference to overhead rates irrespective of any methods of distribution. The overhead may be expressed as a percentage to direct labor hours, direct labor wages, prime cost; or it may be merged into finer groupings by departments, production centers or individual machines. But, be the method what it may, the rate is fixed by the past record. If, for example, the machine-hour-rate method is used the rate per hour is computed by dividing the overhead loaded against the machine by the number of hours it has operated in the assumed normal past period or periods. Whether the number of hours be large or small is immaterial as long as the experience indicates the assumed normality and as long as the facility is not a special service machine.

The greatest value of cost standards appears in price making and estimating. This value is apparent, however, only during the continuation of the past conditions which created it—in other words, a continuation of an assumed normal. Through cost standards an executive may readily determine the quantities of materials, the hours of labor and the amount of factory overhead necessary to complete a given quota of product as long as the product is the same as that in the past; and, if any changes in prices of materials and labor have occurred the quantitative knowledge he has of both will enable him to give effect to the value variations. If standards are so refined as to express costs of individual machine operations or of processes, they are of great value too for estimating the costs of new production.

USES OF PRODUCTION STANDARDS

We have already indicated that production standards are based upon an operating ideal rather than upon past performance. In other words, a production standard is constructed on the basis of an expected maximum performance which includes either full

capacity or a partly scaled down capacity, all depending upon the productive unit under consideration. Production standards cannot therefore be utilized for the same purposes as cost standards, although it is desirable that the two merge into one another as closely as possible.

Production standards are indices of operating efficiency; they are the real yardsticks of productivity. Where, for example, a cost standard may be constructed on the basis of 2,000 hours a year machine performance, the production standard would require the maximum hours so that all except the absolutely unavoidable lost time would be fully utilized. A machine would therefore not be considered as performing its functions completely unless it worked this maximum number of hours.

The value of production standards appears particularly clear in problems of machine investment, and, if factory operations could be properly coordinated, the minimum investment necessary to secure maximum results might be quite readily determined. In other words, if all machines in all departments could be worked on a maximum basis, everything else being equal, it would be safe to assume that only the necessary investment in equipment existed. But ordinarily if all equipment and machines were worked at capacity or at a modified maximum we would find that some machines over-produced and that others could not carry the load.

Production standards, however, if properly applied, do not only establish necessary machine investment but aid very materially in securing the proper proportioning of manufacturing facilities so that the production coming from one group of machines can be adequately handled by the next group. Assuming a certain volume of business, the results of one operation should exactly or as closely as possible measure and determine the machine requirements of the next operation. To illustrate our argument, let us assume two operations "A" and "B" respectively and that there are two machines utilized for operation "A" and three for operation "B." Assuming that one machine of operation "A" works 2,400 hours a year (standard operation) and the other 1,200 hours and that the three machines of operation "B" work 2,400 hours each or a total of 7,200 hours, we at once see (assuming that volume can be increased) that the second machine of operation "A" could be kept at 2,400 hours (standard) by installing an additional machine for operation "B," wherein

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each machine operates 2,400 hours, to take care of the results achieved by 1,200 hours of machine work in operation "A." In other words, the machine proportioning between operations "A" and "B" should be as 1 is to 2, i.e., A:B::1:2 or A hours : B hours :: 1:2, which translated is 4,800:9,600::1:2. Multiplying the means and the extremes establishes the equality. Production standards will point the way toward the proper equilibrium in manufacturing facilities.

A production standard, then, looks primarily toward the establishment of maximum production with an investment just sufficient to produce that desired result. It looks, too, into the problems of minimum labor requirements for the various tasks about a factory and delves with its inquisitorial methods into the very essence of all mechanical phases of production. Production standards are thought of even before the manufacturing plant is erected. Location of plant, the nature and construction of the building, the arrangement of departments, the kind of power, the juxtaposition of machines or groups of machines, the use of mechanical auxiliaries, the location of store-rooms and tool-rooms, the selection of labor and many other matters are considered so that proper production standards may be formulated and made the basis for measuring actual performances, naturally with the hope that the latter may conform as closely as possible with the standard.

The more nearly cost standards approximate production standards the more closely will actual results approach capacity production, assuming, of course, that there is no abnormal abridgment of business. In fact, an ideal cost standard would be a production standard. The difficulties preventing a merger of the two standards are found in the inefficiencies of labor, lost time, breakdowns, etc., some of which are avoidable and others apparently unavoidable. The weakness of cost standards appears in their slavish attachment to past facts arising out of assumed normal conditions. It is assumed that past facts represent the best possible accomplishment and that the past fact occurred under normal conditions. This may or may not be true; many weaknesses may have existed in the past which a cost standard based thereon cannot hope to remedy; and the assumption of normality is a rather dangerous one. To begin with it is a different normality for each plant because each plant has its own experiences and these may vary widely even in similar industries.

In a cost standard, even though properly used, the corrective feature attached to production standards is lacking.

It is desirable that production standards exist concurrently with cost standards and that the results obtained from their application be constantly compared. The first will always represent the application of actual experience rates, whereas the latter will express an application based upon an operating ideal of the maximum. The difference between the two will be the field wherein may be sown the seeds of improvement—improvement in working conditions, in machine arrangements, in departmentalization, in the means for eliminating waste and idle time, in power creation and distribution and in the larger problems of factory coordination and control.

It is my opinion that cost and production standards should not be changed because of subnormal or abnormal conditions in production. The use of the standards under such unusual conditions will clearly demonstrate the factors that are vitally affected by these conditions, and they may therefore point the way to constructive policies which may largely overcome some of the evils arising out of such unusual conditions or at least aid in the establishment of a programme of preparedness.