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Construction, Use and Abuse of Cost Accounts

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The Construction, Use and Abuse of Cost Accounts *

BY SIR ARTHUR LOWES DICKINSON

In recent years much attention has been given to cost accounting, in the use of which this country had, up to the outbreak of the war, been very backward as compared with the United States and still has much leeway to make up.

The pre-eminence in foreign trade which this country has enjoyed in the past is now seriously threatened by the competition with other countries with greater natural resources, lower real rates of wages and greater production per person employed; and while endeavors are being made, as to the success of which there is much difference of opinion, to meet this competition by the imposition of protective duties masquerading under the guise of "safeguarding industries," the only real remedy lies in greater efficiency and lower costs per unit of production and sale.

These problems call more and more for accurate knowledge of costs of all operations from the production of staple raw materials to the final stage of delivery of the finished products to the ultimate consumer either at home or abroad; and to meet this demand the construction and proper use of cost accounts are necessary adjuncts.

It seems pertinent, therefore, that in a gathering of chartered accountants some little time should be spent in considering this important subject in its broad principles rather than its details. It is perhaps to the neglect of these general principles and to the too great elaboration of details forming interesting mathematical studies rather than aids to cheaper and more efficient production that the abuse of cost accounting which is frequently observed is mainly due.

A necessary step to the study of this subject is to consider the object of such accounts. The first object may be stated to be a

* A paper read before a meeting of the Institute of Chartered Accountants at Bristol, England.

determination of the cost of what is sold in order that the producer or dealer may, by comparison with the price at which he can sell, determine whether it is worth his while to do the business and whether his margin of difference is sufficient to enable him to capture markets which are held by competitors. The most elementary instance of this is perhaps the schoolboy sum to determine the price at which a grocer must sell a mixture of two or more teas of varying costs in order to realize a certain profit. The schoolboy accepts the profit as a fact, but the grocer, if he is a wise trader, will so adjust his mixture as to enable him to make profit at a price fixed not by himself but by general market conditions. Applying this very simple proposition to trades and manufactures in general it becomes evident that at every step the mixture of labor, machinery, supervision and distribution must be so adjusted as to allow of the sale of the product at a profit in a competitive market. Even in the case of a monopoly the same principle applies and is well expressed in the words of an American railroad president of the past, that the rates to be charged on a railroad should be "all the traffic would bear consistently with the freest possible movement of the traffic," e. g., an increase in rates may so restrict traffic as to produce lower total earnings, and *vice versa*.

The second object is to obtain the greatest possible efficiency in manufacture by a comparison of the cost of similar processes at the same time, or of the same process at different times. Such comparisons have been found to give most useful results and to have brought about invaluable economies.

A third object is the determination of rates of wages with reference to the cost of product as compared with selling price, of which a prominent example is to be found in the coal mining industry, where statements of the aggregate costs of mining in the different districts form the basis of ascertainment of wages in accordance with the terms of agreements negotiated between masters and men.

A fourth object, which may in future be of ever increasing importance, is to regulate selling prices by reference to costs of production and a reasonable profit thereon. An example of this is to be found in contracts carried out on what is generally known as "cost plus percentage," which has been in use for many years in the shipbuilding industry and by large contracting firms. During the war the prices of many commodities were regulated by similar

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methods and many millions were thereby saved to the country on government supplies for war purposes. An interesting development of the "cost and percentage" method was also evolved during the war, as follows: an estimated labor and material cost was ascertained, to which was added (a) for overhead expenses, either a fixed percentage or one dependent upon an examination of accounts, and (b) for profit, a fixed percentage on the estimated cost; if the estimated cost was exceeded no profit was allowed on the excess, but if the actual cost was found to be less than the estimated a certain proportion of the saving was allowed to the contractor as additional profit.

Fifthly, costs are an important element in the consideration of applications for protection under the safeguarding of industries act, not only by the comparison of cost with selling price, but also as evidence of efficiency or otherwise.

Turning now to the construction side of the question, the simple elements of costs are:

- (1) Raw material.
- (2) Direct labor.
- (3) General works overhead.
- (4) Selling and distribution expenses.
- (5) Administration.

Material is represented by purchased goods which may and frequently do consist of material brought to a certain stage by previous manufacturers, while in some few cases, such as a manufacturer of steel products owning ore and coal, limestone, nickel, manganese, &c., mines, it may be literally prime products of the earth. Direct labor, i.e., labor actually expended on the manufacture, requires no comment. In addition to direct labor, there must always be a considerable amount, such as power, light, repairs, general stores, foremen and timekeepers and factory superintendence, &c., which cannot be attributed to any particular operation and must be spread in a more or less arbitrary manner over all the work in the factory or department of the factory. These, together with other items of similar character, form a group of items generally known as factory overhead. This group is as much a part of the cost of manufacture as are the direct charges of material and labor, and consequently all products turned out must bear their share.

To determine the direct labor and material cost is a comparatively simple problem, although it may often involve a huge mass

of figures and in consequence, if it is not to cost more than it is worth, involve the use of the most efficient labor-saving devices. The time of the operatives expended each day on any particular job upon which they are employed is obtained by the foremen and timekeepers, generally by the use of time clocks and cards or by slips on which the time on each job is noted. From these records, firstly, the pay sheet is prepared, and secondly, an analysis by jobs is prepared, either on analysis sheets, or preferably, if the volume is sufficient, by a system of punched cards and electric tabulating machines. These two summaries are agreed and the job order summary then goes forward into the costing department. It is usual to give job order numbers to each separate operation for which a cost is desired and a separate series of standing order numbers to indirect or general labor, with such subdivisions by departments, shops and even operations or machines as may be required. The result is a complete summary of all wages paid under the headings of each operation for each job under way as well as for each separate expense heading into which wages enter.

Material originates in the material and stores departments, which are charged with the function of maintaining sufficient supplies to meet the needs of the works. These departments may be quite numerous and separated for different kinds of material. The basis of charge for cost accounts is a requisition on these departments for particular jobs, and an analysis of all these requisitions made, if there is a sufficient volume, by punched cards and tabulating machines, supplies the quantities and values to be charged to each order number, whether job or standing. This analysis also forms the basis for credits to the different material and store accounts.

The money rate at which materials are charged out of store is of some importance. The two methods in general use are, either to take the average price shown on the stock account for that material, where individual stock accounts are kept in both money and quantity, or the price of the quantity that has been longest in stock, until that is exhausted. This distribution is not, however, as simple as that of labor so far as it affects either costs or stocks.

In factory operations there must always be loss of material and it is evident that the limitation of such loss is an important element in keeping costs down to a minimum. The loss may be due either to necessary wastage in the operations or to spoilage due to bad or

careless workmanship. The latter can only be controlled by the watchfulness of the foreman, assisted by standards based on past experience as to the number of good pieces that should be made out of a given weight of material. A third cause of loss is the direct abstraction by workmen of finished products, which in the case of small pieces is quite easy and can only be discovered by a search of workmen as they leave the premises. Such search is a difficult and invidious operation and whether or no it is to be made must depend on a comparison between the value of the material and the cost of the friction among workpeople that might be caused thereby. Such abstraction amounts to sheer dishonesty, and while it undoubtedly does occur it may perhaps be considered as an exception and not the rule.

All waste material appears ultimately as scrap, which is frequently of considerable value and may vary from dust and small shavings up to pieces of considerable weight. Scrap is one of the major difficulties in accurate costing and must be estimated on a conservative basis. One method is to treat as the weight of scrap resulting from any particular operation the difference between the weight of the material charged in to that operation and the weight of the finished product credited out. But often the only check upon the accuracy of the estimate is the selling weight when disposed of; and the frequency of check depends upon the system of storing. If separate piles are kept for different kinds of scrap and the piles are not allowed to become too large the risk of error is much reduced, but if all scrap of each kind, or, worse still, of all kinds, is kept on one pile from which deliveries are made and to which fresh scrap is added so that the pile is never exhausted the risk of error is greatly increased and cases have occurred where it has amounted to very large money figures both relatively and actually.

Similar difficulties arise in the case of bulk materials unless care is taken to keep each purchase, or group of purchases over a short period, in separate piles. Cases have been known in which pig-iron, for instance, stored on soft ground has, owing to its weight, sunk in, so that when the pile was exhausted a considerable quantity had disappeared below ground and a shortage resulted, as the expense of mining operations to extract the whole of the vanished material was not justified. Ore piles have been found to be short when finally exhausted due to undiscovered errors in the methods of charging out to operations.

In order to reduce possible errors in quantities to as small dimensions as possible and also to absorb the cost of handling stocks it is a usual practice to add a percentage based on past experience to all deliveries charged out to order numbers. Similarly, where scrap cannot be weighed out at each process it is customary to credit it out on a percentage of material charged, based again on past experience. These arbitrary percentages are a two-edged sword, for if the percentage added is too low or the scrap credited is too high costs may be brought out lower than actual, while in the contrary case work in progress will be valued too high; there will be a consequential error either way in the book figures of stocks. There is, however, an ultimate safety valve in that proper continuous methods of stock-taking will disclose the errors from time to time, so that while the individual costs may be wrong the aggregate financial results may not be materially affected.

It will be seen that the treatment of labor and materials indicated above has the further effect that it makes practicable a book record not only of work in progress and finished, but also of unused materials, stores and supplies; founded on the booking of all invoices inwards in quantity and value and on similar records, plus or minus approximate percentages, for consumption. The advantages resulting from this book record are that it dispenses with the labor and expense of a stock-taking at one particular date, which naturally interrupts manufacturing operations; and by permitting different sections of materials and stores to be verified by an inventory at odd dates and then adjusted with the book records stock-taking can be spread evenly over a fixed period.

It may be not amiss here to refer shortly to different methods of keeping the money values of materials and stores. In some cases it is customary to keep an account of every unit in both quantity and value, but this is necessarily an expensive method and one which should not be adopted unless it is absolutely necessary. A second method is to divide them into classified groups, each group consisting of somewhat similar items, and then, while keeping an account for each unit in quantity only, with a note of the unit price as this varies, record aggregate money values for each classified group only. In this case a physical stock-taking of each group would be taken periodically and extended in money values, and any difference between this value and the book value investigated and adjusted. Assuming, say, twenty-four such groups, this would mean that two groups would be thus verified

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each month, by a small staff kept continuously engaged on such work, in order to complete the entire stock-taking over a calendar year.

Another advantage resulting from such a system as has been indicated is that it becomes possible with a remarkable degree of accuracy to determine month by month the approximate cost of all sales for that month and so enables the administration to have before them early in the following month a complete statement of profit and loss, prepared on a conservative basis and supported by the results of completion of individual orders and contracts. These latter will be affected by the method adopted for distribution of factory overhead, but if a careful watch is kept over the amount of such overhead carried in stock, no serious error in the aggregate profit is likely to occur.

Costs of operations will necessarily vary from period to period according to the change in prices and wages, and perhaps even more due to the variation in overhead arising from the change in the percentage of factory capacity in use from period to period. As long as production is exceeding sales it is a simple matter to take the costs of sales for the period as a charge against proceeds of sales, and carry the remainder of the cost into stock. When sales exceed production it becomes necessary to withdraw from stock the cost of the excess sales, either at the average of the costs charged into stock from time to time or at the cost of that which has been longest in stock. As long as there is no continuous rise or fall in costs this method is probably sufficiently accurate for all purposes, but when there are material changes in values in one direction it will be necessary to adopt the more correct method of charging as cost of sales not the cost for the period but the cost at which units have been charged into stock until stock at the beginning of the period has been exhausted, and then only to take the cost of the period for the balance.

In such conditions the first method would, in the case of falling prices, tend to inflate stock quite seriously with possibly disastrous results later on, while in the case of rising prices an unknown reserve would be built up. This is an instance of the necessity, in dealing with cost accounts, of the most watchful regard to principles and of the danger of neglecting principles and trusting to machine-like decimal accuracy.

It is of the utmost importance that such monthly statements should be prepared promptly in order that the management may

be in a position to deal without delay with any adverse tendencies disclosed therein. Results of individual contracts and orders disclosed months after they have been completed and delivered are of little or no use to anyone; nor are profit-and-loss accounts, prepared months after the period to which they relate, of use to the management, except for presentation to shareholders and declaration of dividends. Statements thus delayed may perhaps be compared to a nurse who should inform the doctor of the temperature and pulse of her patient some weeks after they were actually recorded.

In the United States it was common practice even fifteen years ago in large industrial undertakings to have production statements before the officials in the first few days of the following month and complete profit-and-loss account, by the 10th of that month, and today these figures are frequently available within a few days of the close of the month to which they relate.

Having dealt with the principles involved in the distribution of materials and labor, it remains to consider the more difficult question of the distribution of overhead expenses, upon which there are many differences of method and opinion.

The simplest and perhaps most usual method is to take the total overhead expense and divide it either over units of manufacture or productive wages or labor and material costs. Where a factory is producing only one kind of product which passes through all processes the results of such methods will be sufficiently accurate for all purposes. In the case, however, of a factory making various kinds of products, passing in the process through some only of the many departments, such a method may introduce serious errors, as, for instance, charging a product made entirely by hand with a proportion of the cost of a power plant used only in other departments of the business.

To meet these conditions other methods have been devised. While it is not possible (by the definition of overhead expense) to charge any of it directly to a particular job or operation it is evident that many expenses may be treated as direct charges either to a particular department or even to a particular machine in that department and, the number of hours expended by that machine being recorded, a basis of division by machine hours or man's time or pay can be easily adopted.

In the first place, therefore, overhead expenses would be divided into direct charges against departments and into charges

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common to all departments; the first group would again be divided into those appertaining to particular machines and operations in that department, and into those which are common to the whole department but cannot be allocated directly to any machine or operation. In this way the overhead may be divided into a large number of classes and the problem then becomes one of distribution, and this can only be decided by a careful study of the nature of the various operations. In some cases floor space occupied may be found suitable; for others, machine hours; for others again, man hours; and there are also in common use distribution over units manufacture, direct wages cost or direct wages and material cost.

It will be seen that the method here outlined, if carried out in full, is very elaborate and involves a great amount of detailed analysis. Its use is only justified where a large diversity of products are manufactured, the operations on which are so dissimilar that nothing short of such a division of overhead expense will give sufficiently accurate results to enable a close competitive selling price to be determined. Where this is not the case, and in simple industries, such as mines, steel works and factories putting out only a limited variety of standard products of a similar nature, this elaborate system of distribution is hardly justified and the simpler system of dividing all overheads as a percentage on labor will produce sufficiently accurate results. A simple instance of wasted elaboration in determining costs was found in the course of an investigation of the accounts of two engine works for the purpose of amalgamation. Each concern had a foundry in which all its castings were made, the weights varying from a few ounces up to several hundredweight. One concern charged all its castings into its engine costs at 1d. a lb., while the other had an elaborate system of arriving at the cost of each casting. The latter concern objected to the rough-and-ready 1d. per lb. as entirely inaccurate, and to settle the question the accountants took a specification of the standard engine, worked out the cost of all the castings individually and so arrived at an average cost per lb. which was found to be within a negligible percentage of the 1d. per lb. adopted by the other concern. This is probably a good instance of how expert knowledge of manufacturing processes backed by careful test costs may save a large amount of time and expense and still get accurate results.

Another principle that must always be remembered in relation to the overhead expenses is that when the output of a factory has reached a point at which it can absorb the whole of the overhead and still leave a reasonable margin between cost and selling price, any additional product can be either manufactured at a higher cost or sold at a lower price because it is no longer necessary that any overhead expense should be taken into account in arriving at its cost; in other words, any slight margin of selling price over labor and material cost will yield a profit and make it worth while to continue production. Similarly, when work is slack and orders can only be obtained at prices which in ordinary times would be unremunerative, it may pay to take them at a small profit on labor and material only in order to reduce the burden of overhead and so make a profit on the regular business.

One common method of dealing with overhead expense is to adopt as a basis certain percentages or other allocations based on past experience and to treat these as standard, charging costs and crediting nominal accounts to which the actual expense incurred becomes a charge. The proof of the accuracy of the distribution is in the approximation to a balance over any period in these nominal accounts, and the percentages should be sufficient to leave in normal times a small credit balance thereon.

Whatever method is adopted, an important question in connection with overhead arises when a factory running on normal production with a steady percentage of overhead falls upon bad times and its production is so reduced that on the normal distribution the overhead is not fully absorbed by the lessened production. Either the overhead should be spread at a greatly increased percentage over the actual production, or the normal percentage should be continued and the unabsorbed overhead charged to an idle plant expense account. In arriving at profits, idle plant expense must be provided for, but it would seem better practice to provide for it by a charge direct to profit-and-loss account rather than a charge to orders, i. e., to costs, thus unduly inflating the latter and perhaps tending to a further restriction of production on the ground that the product can no longer be sold at a profit.

There is some difference of opinion, even among accountants, whether or no rent and interest should be included in overhead expense and treated as part of the cost of the product. The sounder view seems to be that both these items represent either a part of the profits or a fixed contribution in lieu of profit paid to

those who provide a part of the necessary capital; i. e., fixed capital in the case of rent and either fixed or circulating in the case of interest. These two items in any case only represent the charge for the use of part of the capital and if they are to be included in costs it is surely inconsistent not to include a charge for the rest of the capital employed. Moreover, of two firms with the same amount invested and making identical products, one may borrow half its capital and the other none, and it is surely inconsistent to suggest that the cost of the product in the first case is higher than in the second.

The advocates of including interest as part of costs are in another difficulty in determining the rate of interest to be charged. The old theory of economics was that it was the rate at which money could be invested entirely without risk. In the closing years of the last century the nearest approach to such a rate was that yielded by $2\frac{3}{4}$ per cent. Consols, then quoted at considerably over par, and yet a purchaser in, say, 1898, would, by holding until 1916, have lost by depreciation in market value as much as the whole interest collected during the intervening period of years.

In fact, money is invested in industrial enterprises in order to obtain an annual return thereon, and it seems inconsistent to claim that in the case of an investment in government securities the return is to be deemed interest, but if in commerce partly interest and partly profit. It is true that in deciding where to place his capital an investor measures up the risk he is incurring and that this determines in the long run the rate of return, i. e., the price of capital, but this only expresses the rate of interest prevailing at any time for capital employed in different businesses and does not justify an arbitrary and illogical division between interest and profit.

While the balance of argument would seem to be decidedly against interest being an element of cost, it is clear that the time taken over an operation is a material factor in its cost and one which is not taken into account in the methods of determining costs already set forth. If two articles involve the same amount of labor and material, but one takes twice as long to make as the other, there should be some way of indicating its excess cost by reason of its greater use of capital facilities provided. Factories and machinery are usually erected with a good idea of the return to be obtained from their use and this rate of return, calculated on the capital value of all facilities used for the manufacture of the two articles for the time during which they were so used and added to the labor, material and overhead cost would at once

show that one had cost more than the other. Unfortunately this method would include in cost the whole of the estimated profit and is therefore quite inadmissible, and there seems no reason for charging interest at any lower rate. Further consideration shows that what is really wanted is a comparison between the profit realized on the two articles, i. e., the interest earned on the capital employed in each case. This can be readily obtained as a statistical figure by comparing the difference between selling price and cost (as ordinarily determined) with the capital facilities used in producing each, taking into account the time for which they are used. Thus, if the surplus of selling price over cost for two products be X and Y respectively, the capital facilities employed P and Q, and the time for which they are employed H and M, then the return on a unit of capital for a unit of time will be $\frac{X}{P \times H}$ and $\frac{Y}{Q \times M}$ respectively. The relative value of these two expressions will indicate which commodity produces the greater profit. If one shows a smaller return than the other it then must be determined whether its manufacture is so essential that it must be continued in spite of this lower return, or whether it can be purchased outside to greater advantage or can be abandoned altogether in favor of a greater output of the more profitable article, bearing in mind that any considerable increase in units produced may result in reducing the selling price to a greater extent than the saving in overhead expense due to the greater production, and so reduce the profit to or even below that earned by the other product which it is proposed to discontinue.

In considering a complete, detailed cost system on the principles outlined above it should not be overlooked that there is another method quite commonly adopted, much less costly, and often quite as accurate and satisfactory, particularly in machine shops not engaged in producing standard products but manufacturing to the order and special requirements of customers. In such a factory, while the finished products are not standard, they usually involve a large number of standardized parts, and it is in the assembling perhaps, and in a small number of special parts, that the difference occurs. In such cases it is often customary to work on the basis of test costs, i. e. specially skilled men estimate the material, labor and overhead for each operation and so arrive at the approximate cost of the whole, taking care that their

estimates are on the safe side, i. e., are over and not under the probable cost by a safe margin. On the basis of these estimated costs contracts are taken and all finished products are valued out, the stock of work in progress, raw material and stores being represented in the books at any time by the difference between the total charges to the factory and the credits for finished goods shipped out.

This method has been used for years by one of the largest factories in the United States; a staff of skilled men being continuously employed in calculating and revising test costs; its accuracy was proved each year by the very close agreement between the book stock figures and the result of the physical stock-taking.

Difficulties arise in determining the division of costs between two or more products derived from the same raw material which pursues a common course through certain operations up to the point at which the two products are separated and are thereafter submitted to different operations before they emerge as finished products. The extreme case is that in which one or more of the products can be treated as a by-product or residual, either owing to the relatively low value or to the small quantity produced. In such cases it is usual to credit to the cost of the main product the selling value of the by-products, less some percentage to cover cost of sale.

At the other extreme is the case in which all products are equally important and a cost for each common to all or some few of these products is desired. This can be obtained by dividing them either:

- (a) in proportion to weight or quantity produced, or
- (b) in proportion to selling value of the final product, or
- (c) in some arbitrary proportion based on experience of relative values over a series of years.

It has happened that, by changes in markets, products that were at one time treatable as by-products increased in importance so that they become main products, while the former main products become by-products. To show concisely the complications involved, assume two products, A and B. As market conditions vary A may pass from a by-product up to equality with B and pass B, while B may descend to the position of a by-product, A becoming the main product. In this way each one of the methods of determining costs mentioned above may theoretically come into force in turn.

There is no lack of illustration of the occurrence of these conditions, e. g., by-product coke ovens producing coke, gas, sulphate of

ammonia, tar and many others; metal separation where a large number of metals, e. g., copper, nickel, gold, silver, &c., may all be obtained in greater or lesser quantities from the same ore; and oil refineries where large quantities of the different products of petroleum are obtained out of the same crude oil.

It must not be overlooked that for most purposes there are two costs, viz.: (a) factory costs, i. e. labor, material and factory overhead only, and (b) selling costs, which would also include selling, distribution and administration expenses. Factory cost broadly represents the cost to the producer of his finished product delivered to stock, while selling cost includes also the expense of selling and distributing which still has to be incurred before the final profit can be determined. In theory, administrative expense should be divided between factory costs and selling costs, but in practice it is more usual to treat it as a separate item to be met out of the excess of sales over selling cost.

In many cases, such as contracts, special orders, &c., goods are sold before they are manufactured; factory cost and selling cost, excluding distribution, are then in effect identical figures. For accounting purposes the distinction between the two is chiefly of importance in the valuation of stocks on hand, which by conservative convention are usually taken at factory costs only, assuming, that is, that this is less than market value. If the products are in fact sold, selling cost (excluding distribution), if less than selling price, may safely be used. Any greater valuation is an anticipation of profit which may not be realized, although there are cases in which such anticipation on a conservative basis may be justified and even necessary, e. g. in large contracts extending over a period of years.

It has been argued that factory cost for stock-taking purposes may be taken at date of stock-taking, instead of at that which actually went into the product. It is submitted that this is an erroneous principle and entirely loses sight of the meaning of the word "cost"; in effect, it is taking into stock the profit due to goods having been manufactured on a lower basis of prices and wages than prevails at the time of stock-taking, a profit which can only be realized by the subsequent sale of the goods. It is, however, clearly the function of the cost accountant to determine not only past but present costs, and for this purpose it may often be necessary to adjust his actual costs by charging labor, material and overhead expenses at prevailing rates at the time. Where

this is done the increase or decrease in costs resulting from the use of current instead of actual rates should be shown separately.

This sketch of costing methods and of some of the difficulties and problems involved therein leads naturally to the consideration of the use to be made of the costs when obtained, and the factors which should guide when settling the methods to be adopted.

First and foremost must come the nature of the information which practical managers and heads of departments desire to enable them to get the best results out of the business. Secondly, there is the information which is required by the directors, who want to be able to judge of the progress and results of the business by a summary of figures as short and concise as possible. Thirdly, there are the statistical accounts and figures required by government departments to form the basis of trade reports relating to the whole country, e.g. coal. Lastly, there are the accounts and statistics required for the purpose of wage agreements with employees, when such exist, and for the shareholders who in these days are too often left with little or no information that would be of use to them in forming a judgment on their investment.

It may be safely said that of these four groups the first is of the chief importance, and that if the management are getting all they require for the efficient conduct of the business the other information is easily computed. A statistical department should be a necessity in any moderately large undertaking, to which department the cost and accounting returns should go to be examined and compared and put in the form that will be most useful.

Then again, some returns are of immediate and urgent importance and will be useless to the management if they are submitted more than a few days after the close of the period to which they relate. If presented months later they are in fact matters of history, interesting no doubt to statisticians and historians, but relating to a state of affairs long since passed by. A danger in a statistical department is that it is apt to acquire a craze for statistics as such and to prepare figures which are of no particular use to the management and from the business point of view are mere waste of time. As a practical instance may be noticed the case in which the costs of an operation which is common to a number of orders are found to vary from 3s. 6d. per unit down to 6d., for reasons peculiar to each order and well known to the technical management. The statistical department goes to some trouble and expense in working out the average cost of the

operation for all orders, thus providing a figure not only useless but misleading, and depending on each occasion on the proportion of the different orders in hand over the period in question.

A first essential in designing any system of cost accounting is to find out what are the essential accounts and statistics which the management require in their daily work; to improve and elaborate these in consultation with the management; and to produce a system which will give these results and waste no time in getting out others or in making elaborate calculations which may be mathematically interesting but are practically useless.

A curious instance of erroneous use of statistics may be noted in a pamphlet recently issued in connection with the coal strike. Tables were presented showing the minimum wage fixed for different classes of labor in the various districts in the country, which in one class ran all the way from 47s. to 82s. per week. At the foot of the page the average minimum wage for the whole country was given as 71s., a figure of no real practical importance. The pamphlet, however, went on to make the astounding statement that in the whole country no man of this class could earn less than 71s. per week, and a similar error was made in all classes.

A great quantity of statistics of the coal industry have been published as evidence in the various inquiries that have taken place from the commission of 1919 to that of this year. The great bulk of them are both valuable and interesting, but scattered about among them may be found some that are merely interesting figure exercises of no practical importance and which illustrate the foregoing criticism of the preparation of useless statistics.

A word of warning against the free use of average figures may not be out of place, even in this assembly of accountants, in view of the misuse of such figures which frequently occurs. To take an average cost of an operation where the individual costs are more or less the same and fluctuations are not due to any intrinsic difference in conditions, is not only justifiable but useful, as the average figure for the purpose of accounts and statistics is quite a reliable guide. When, however, conditions vary materially in the different unit operations which go to form the average, the use of the average figure is most misleading and may easily be dangerous. The statistics of costs and wages in the coal industry which have been much before the country of late afford a good instance. The published figures of costs, proceeds and profits or losses are prepared for 13 different districts and the figures for each district are

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an average of all the undertakings in each district. In any particular district, as has been shown in evidence, the results may vary from, say, 6s. per ton loss in a mine at the lower end of the scale to 6s. per ton profit at the other end, so that the average figure of, say, 2s. 6d. per ton profit gives no idea of the real conditions prevailing, as there is no pooling of profits and losses. Similarly, the average profit or loss for the whole country, the average wages cost and earnings per person employed, taken by themselves, are of very little real use except to show what the results might be if all the mines were in fact combined in a single undertaking.

Similarly misleading average figures may be found in many other cases, and it is imperative, therefore, that those engaged in the preparation of cost accounts and statistics should use every precaution to see that the figures they produce are accurate reflections of facts and not merely misleading generalities.

When there is in being a complete cost system great care should be exercised in preparing summary statements for the use of officials and directors, who are usually busy men desiring to leave all detail to their subordinates and dealing themselves only with important variations. Frequently the statements submitted are quite bulky and contain no short summary which will convey in a few figures all salient facts.

As an instance of a form which will convey the necessary information quickly and easily the following may be given, to be prepared for each class of product or group of products, as may be appropriate:

Sales, in quantity and value	
<i>Deduct—</i>	
Cost of sales, per unit or percentage and amount	
Gross profit, per unit or percentage and amount	
<i>Less—</i>	
Selling and distribution expenses	
Administrative expenses	
Net profit, per cent. or per unit and amount	

This statement would be supported by a subsidiary statement explanatory of cost of sales, viz.:

Stock of finished product at beginning of period, quantity and amount	
Wages, per unit or percentage and amount	
Materials " "	
Overhead " "	
Total	
Less stock of finished products at end of period	
Cost of sales	

Also there would be an analysis of selling and administrative expenses under suitable headings. All these statements should show the figures for the period under review, the previous period, and the corresponding period of the previous year.

In addition to these statements, which in effect form a summarized profit-and-loss account, there would be purely statistical statements varying according to the nature of the business, and in deciding upon these an intimate knowledge of the business is required so as to determine which statistics will be of use in reducing costs and improving processes of manufacture. The accountant must put himself as far as possible in the place of the manager and show that he is not only competent to prepare the figures with a sufficient degree of accuracy and at a minimum of expense, but that he knows how to apply the results so obtained to the practical side of the business. By such qualifications alone will he be able to sift his material into what is useful and what is superfluous, and so avoid the preparation of useless or immaterial statistics whose only merit lies in the mathematical accuracy of the calculations.

In this connection it may be opportune to register a protest against the common form of trading accounts and profit-and-loss accounts still too often prepared by accountants. It is high time that these were abandoned in favor of the form given above, which has been commonly in use in the United States for a quarter of a century but makes way slowly and with difficulty in this country. Shortly, the difference may be expressed as accounts prepared according to headings of service instead of by account names. There is no real reason why every account should not be prepared on the basis of service; yet frequently where the company or firm prepares its monthly or quarterly accounts in this form the accountants at the end of the period will revert to the old-fashioned debit and credit form of manufacturing and trading accounts, classified according to account names.

The further development of cost accounting depends to a large extent on the greater use of mechanical devices, so reducing the expense of obtaining figures which, without such assistance, would cost more than the savings that might be obtained thereby. A full consideration of these devices would require a complete paper and can not here be attempted. The main features consist of cards divided into fields, each of which represents one particular factor, quantities or values being represented by perforations in these fields. Sorting is done by means of needles passed through

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the perforations, either by hand or by electrical contacts, and tabulation by means of other machines, worked either by hand or by electricity. The efficiency of such methods depends largely on the volume of the original data with which it is desired to deal, and the greater the volume and the more continuously the machines are employed, the greater will be the economy. The problem of the efficient use of such methods is complicated by the human element, which sees in their adoption the displacement of human by machine labor, just as was the case in the middle of the last century when the introduction of special production machinery in the wool, cotton and other staple industries paved the way for the predominant industrial position which we still hold, in spite of our present, and it may still be hoped, temporary adversity. The answer is the same, viz., that anything which tends to reduce expense will in the long run increase employment; but this is not much consolation to those immediately displaced, and unless they can be cared for continual opposition must be expected. Tolerance of the doctrine that the few must suffer for the benefit of the many or their posterity can hardly be expected of the few.

In concluding this survey of cost accounts it is permissible to consider for a moment the public aspect of the question and its ultimate effect upon the relations between capital and labor, and between producer and consumer. These relations are at present very much under discussion, and if industry and all it means for the maintenance in reasonable comfort of a congested population is to survive it is clear that the era of suicidal strikes must be quickly banished and superseded by some more sensible methods of avoiding, if possible, but at any rate of settling, disputes. The impression is gaining ground that the present disastrous conditions are largely due to the intense secrecy which prevails as to the real costs of production and of the disposal of the resulting profits. If every producer and wholesale and retail dealer were to publish the salient features of his business none would be unduly prejudiced unless he were retaining an undue profit. The experience of those members of a trade who were doing well would be available for the use of others doing badly, and in fact the same comparison of costs would be available between different producers as is now available within one organization as between its different factories. Such publicity would in the long run tend to reduce cost of production and distribution throughout the industry; to a fair division between wages and profits; and to a fair price to the consumer.

Up to the present competition has been relied upon to produce all these results, and yet it is fairly clear that no great measure of success has thus been reached. A beginning of new methods, however inefficient, has been made in the coal industry, and while the present results are somewhat disastrous it would seem from the report of the coal commission that the disaster is in fact to a great extent the result of many old-fashioned and inequitable methods which that commission has disclosed.

The seeds of better methods have been sown, and if all parties, forgetting their quarrels and the extreme and often absurd methods of socialism and bolshevism as well as of individualism, will work together to nurture the seeds into strong plants, the nation may redeem its position, and with its invaluable natural resources and energy regain its former prosperity with a fairer division, among all classes, of the accruing wealth. The foundation must be publicity, and publicity in a form and sense that is at present but little understood, but essentially publicity in costs of production and distribution, with a fair price to the consumer and a fair division of the balance between labor and capital.

For the solution of this problem it is essential that service to the community should play a much larger part in industry, and at least an equal part with individual profit. The present idea that a business belongs only to those who own the capital therein must give place to a new spirit that it belongs to all who contribute to its success, whether as capitalists or as brain or manual workers, and is a trust for the benefit of the consumer and the nation. This is a high ideal which may never be reached, but it can remain an ideal towards which continued progress may be made, and while one of the keys to it is a better understanding, with goodwill and coöperation between capital and labor, another is held by the accountant, whose province is to devise and propagate methods by which all the essential facts in industry may gradually become the property of the community.