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Standard costing and scientific management

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STANDARD COSTING AND SCIENTIFIC MANAGEMENT

Abstract: Many have suggested that scientific management had a direct influence on the development of standard costing. This paper examines the relationship between these concepts in broad terms. While it is concluded that no direct relationship exists between scientific management and standard costing, the existence of an indirect relationship is acknowledged. Scientific management does not require any specific type of accounting system and standard costing does not require a certain type of management organization to operate. However, certain reports developed for the scientifically managed enterprise, when added to the germs of standard costing that existed, expedited the evolution of standard costing.

In 1970, the AAA Committee on Accounting History suggested among several research topics, one looking into the effect of scientific management on the development of standard costing. Prior to this, a number of authors suggested that there was a relationship between the two areas.[1]

A number of different statements have been made regarding the development of standard costing. These include the following:

—Standard costs . . . represent the application of the scientific management idea in one division of the business . . . the factory.[2]

—Standard costing undoubtedly originated through the comparison of actual costs with estimates. As estimating became increasingly scientific and accurate, the possibilities of eliminating much of the detailed cost finding and of controlling costs of production in bulk were visualized.[3]

—Although scientific production control (beginning in the 1880's) may have predated the "not so well known" scientific cost control by about one third of a century, both had . . . an engineering origin.[4]

These, however, do not clarify the evolutionary process.

This paper will not be an attempt at a complete documentation of significant events in the development of scientific management and standard costing.[5] It will present some background information, a

broad comparison as to points of similarity and difference, and a discussion of whether or not scientific management affected the development of standard costing.

Estimated Costs

> For which of you, intending to build a tower, sitteth not down first and counteth the cost, whether he have sufficient to finish it? St. Luke 14:28

The concept of estimated costs is a long standing one. There were some developments in this area, both prior to and concurrent with the evolution of the principles of scientific management, that support the view that standard costs evolved from estimated costs. Many of these were described by Sowell and only a few key items will be mentioned in the present discussion.

Cronhelm (1815) mentioned an estimating method which hinted at the idea of quantity standards: ". . . not, however, in the quantity of that material, but in the quantity of manufactures which it *ought* to produce, according to those rules and proportions which are estimated in all regular and well managed concerns."[7] Babbage (1841) touched upon the idea of efficiency:

> "The great competition introduced by machinery and the application of the principles of the subdivision of labour, rendered it necessary for each producer continually to be on the watch, to discover improved methods by which the cost of the article he manufactures may be reduced, and with this view, it is of great importance to know the precise expense of every process . . ."[8]

Garcke and Fells (1893), while also using the term "cost estimate," felt it was necessary to know the cost of production in terms of estimates of wages and materials, *before* manufacturing any order so as to keep such costs at a minimum.[9] They suggested that:

> ". . . before any order to manufacture is given it is advisable as tending to produce greater economy in cost of production that the person being acquainted with its processes and details should estimate the probable cost to be measured in wages and materials, in the production of the article in question. This estimate should be a minimum rather than a maximum one, and the storekeeper, having been furnished with the particulars of it, should not

> issue more material for the order than is estimated without authority."[10]

In the early twentieth century, three interesting views were expressed. Burton (1900) recognized the importance of the engineers and "advocated a standard estimate for each standard type of machine."[11] Goode (1900) urged the use of pre-determined production cost for a standard quantity of each item produced[12] and presented a method for analyzing deviations from this amount which resembled the rate and quantity variances of standard costing.[13] The third idea was expressed by Lean (1901); he felt the cost accounts should, among other things, show the estimated and actual costs related to a standard unit of weight.[14]

Such views lean toward standard costing. The methods used to develop the estimates, however, generally were based upon past experience or the expertise of the person responsible for establishing the estimates rather than on a scientific analysis of the production process. One early contributor to standard costing, J. R. Wildman, on emphasizing the difference between standard and estimated costs, said that " 'predetermined costs should be technically distinguished from estimated costs, in that they are constructed from predetermined standards scientifically obtained.' "[15]

Standard Costing

> . . . it is more important to know how much a product *should cost* in detail and to ascertain only the amounts and causes of any excess over this cost than it is to know how much a product *has cost* in detail but with perfunctory knowledge of much it should cost.[16]

Standard costing and standard costs have been defined in many ways in the early literature. Two comprehensive definitions have been suggested:

> . . . standard costing is a method of ascertaining how much costs should be and analyzing the causes of variations between how much they are and how much they should be.
>
> Alternatively, standard costing is a scientific method of developing a comprehensive series of cost standards to cover the activities of a business, of comparing actual costs against cost standards in such a way that the causes of variations are revealed in full detail, and of combining the variations to form a complete statement of profit and loss.[17]

Many definitions of "standard cost" exist, ranging from a benchmark to "an accurately developed measure of the cost of performing specified work under predetermined conditions."[18] The difference between standard and estimated costs is more fully described in the following statement by C. Bennett in 1922:

> "A great difference exists between modern standard costs and the cost estimates mentioned by some mills, which they sometimes confuse with standard cost methods. Approved predetermined costs reflect what the costs of each style should be and represent the results expected from the mill. Actual results are carefully controlled and kept within the standards in all possible areas . . . thus while standard costs are considered as representing the real cost with the actual results accordingly gauged, estimated costs are merely guesses with periodic attempts to reconcile them with actual operating results. Modern standard cost accounting methods decide what costs should be and then take steps to realise these standards through actual operating."[19]

One of the main functions of the cost accountant is to advise management of exceptions to planned performance. "The cost accountant who is called upon to provide an efficient measure of performance must devise a measuring stick from which as far as possible all factors have been eliminated except for the factor, production efficiency, which he wishes to measure."[20] While the use of "estimated costs" can develop deviations from spending plans, it does not differentiate between those from price changes and those from efficiency changes. Standard costs aid in highlighting production efficiency since variations due to fluctuations in actual prices are eliminated and the basic comparison is between actual input quantity and standard input allowed for the actual production output. The concentration on the differences from predetermined costs aids in cost control, among other things. Before-the-fact knowledge leads to general expectations throughout the appropriate areas of the firm and the coupling of this with "management by exception" provides for cost control as well as performance evaluation.

Scientific Management

> The essential core of scientific management regarded as a philosophy was the idea that human activity could be

> measured, analyzed, and controlled by techniques analogous to those that had proved successful when applied to physical objects.[21]

The development of the principles of scientific management generally is attributed to the efforts of F. W. Taylor, who was interested in a "system of shop management."* Harrington Emerson saw a greater importance to scientific management:[22]

> . . . the underlying idea of scientific management is the predetermination of results and the standardization of methods and conditions. Instead of working to more or less nebulous ends, under scientific management methods definite ideals are established and all efforts concentrated towards the attainment of these ideals by adoption of standardized methods . . .[23]

A standard under scientific management was defined as " 'a carefully thought out method of performing a function, or carefully drawn specification . . . The standard method of doing anything is simply the best method that can be devised at the time the standard is drawn.' "[24] The most difficult standards to set were those for time because of the need to allow for planned idle time. Drury said that "the original reason for the infusion of standardization into scientific management was a demand for it on the part of scientific rate fixing."[25] This was discussed more fully by Simeon:

> The labor cost is that portion of the total cost which is generally th largest and nearly always the most elusive and difficult to regulate. Accurate, prior knowledge of the time in which work should be done has a value that cannot be overestimated in reducing the labor cost under day work, and is an essential under piecework, bonus, premium or kindred system.[26]

Scientific management was concerned with the elimination of waste—"waste of material, labor, equipment and capital."[27] As an aid in carrying this out, the exception principle, whereby manage-

*The four principles of scientific management are:

1 " 'the development of a true science,' " the reducing of all things to law;
2 " 'the scientific selection of the workman;' "
3 " 'his scientific education and development,' " or " 'bringing the science and the workman together;' "
4 " 'intimate, friendly cooperation between the management and the men,' " or the almost equal division of the work.' "

Copley, Vol. I, pp. 329-330.

ment received condensed, comparative reports which highlighted all deviations from standard performance—good and bad, was emphasized as a way of giving a quick picture of current progress, or lack thereof.[28]

A basic part of scientific management was to provide the factory, *ex ante,* answers to the following questions: "Exactly what has to be done? What is the best way to do it? How long should it take?"[29] This led to the idea of the task, which formed the basis for much of scientific management. Under this concept, the workman's job was completely determined beforehand and, frequently, he was given detailed instructions specifying the job, how to do it, what tools to use, and the exact time to use.[30] These instructions were based upon the standards as developed under scientific management.

A. H. Church, in discussing the meaning of scientific management, felt it conveyed two basic ideas: 'the planning of industrial activity from the consideration of its simplest units" and "the predetermination of standards of efficiency."[31] He also emphasized that "scientific management is a body of principles" rather than a system. He summed up his views as follows:

> . . . it is the application of accurate thinking, accurate planning, and accurate doing, so as to increase output, reduce cost, and by consequence render available a larger margin of surplus for division between employer and employee.[32]

Scientific Management and Accounting

> . . . . costs are the foundation on which scientific management must be built. They enter very largely into the whole structure, and finally they support the roof.[33]

In the literature on scientific management there are several references to the role of accounting in ensuring the success of the scientifically managed enterprise. Taylor, himself, was involved in developing accounting systems for the firms that adopted the principles of scientific management, and was called a "pioneer in the development of modern industrial accounting" by his biographer.[34] The old cost accounting methods no longer were appropriate; the accountant had to adopt the "engineering point of view"—the need to look ahead rather than only to record the past.[35]

The Taylor system "required prompt and accurate reporting of costs."[36] As a by-product of this system for improving efficiency,

cost data leading to "quicker and more accurate reporting" are generated.[37]

> Accurate detailed Costs are essential for economical production. Under scientific management the costing system forms one of the principal factors in controlling the general efficiency of the work. . . . A good costing system . . . enables the management to be in constant touch with every factor that affects economy of production.[38]

In the 1890's Taylor realized that timely cost information was necessary and, to achieve this, developed the monthly report and, later, the daily report (previously, reports were annual or semi-annual). He also placed the cost accounting function in the planning room and integrated the cost accounts with the main set of books.[39] The move to the planning room ". . . made cost accounting a by-product of operations, and thus got . . . costs *coincidentally* with the operations."[40]

In 1898 Taylor, in a report written to Bethlehem Steel outlining the cost and accounting system he wanted to install, said:

> "It is evident that the system of bookkeeping in each large manufacturing works presents a problem distinct from that in almost any other establishment since the methods of manufacture, the nature of the product and the information called for by the officers of the Company differ in each case to such a great extent. The bookkeeping system must in each case, therefore, be so arranged that it fits into the piecework plan and the general method of running the works at one end, and at the same time it must be especially adapted to giving the various daily and monthly reports called for at the other end, . . .
>
> The system should insure an accurate determination of the cost of all goods manufactured by logically and exactly distributing at the end of each month the total expenses of the month . . . onto the articles of manufacture which were worked up during the month, and complete comparative cost statements for all articles completed during the month should be . . . handed over to the proper officers of the Company. . . ."[41]

The accounting systems set up by Taylor were detailed as to the type of accounts and reports to be utilized and affected the entire organization.[42]

By 1909, in a Harvard lecture, Taylor had changed his views regarding the importance of the cost accounting system to scientific management.

> ". . . Fifteen to twenty years ago I looked upon a current cost system as one of the most important among the various elements of management, and in fact devoted a large part of my time to introducing systems of cost and of expense analysis in manufacturing establishments. Now, however, under the moden scientific management, as far as they *influence cheapness of manufacture*, costs and expense analysis become, comparatively speaking, elements of lesser importance, and we generally leave them to last in the introduction of our system. . . . Costs are needed, in many cases, in order to regulate the selling prices, also for the general education of the sales department, and for deciding upon the future lines of progress for the business. But under scientific management what was formerly their chief value, namely, helping to get a low cost of manufacture, almost entirely disappears. . . ."[43]

This view was expressed again in 1911: " 'My experience has led me to place less and less faith in accounting as a road to economy.' "[44] Taylor was especially concerned with the inability of accounting to provide remedies for the inefficiencies it turned up.

Two types of standards existed in these early years: production and cost. Production standards were emphasized under scientific management:

> . . . a production standard is constructed on the basis of an expected maximum performance. . . . Production standards are indices of operating efficiency; they are the real yardsticks of productivity.[45]

Cost standards, on the other hand, were "based on actual experience as evidenced by past records indicating normal conditions."[46] While production standards were viewed as being interested in achieving maximum output at a minimum investment in the factors of production, they were not appropriate for most costing purposes; however, it was felt that they should merge with the cost standards as much as possible.[47] The two standards could, and should, exist concurrently and the results from their application should be compared constantly. Emerson carried this idea further: "It is . . . very important that both efficiency statements and cost statements keep

close together, that both shall use the same unit, that both shall use equivalence (standard cost) and that expense be stated in two terms: Standard Cost and Waste."[48]

General Comparison

> No one can read Taylor's famous paper on "Shop Management" of 1903 without seeing that many of the essential elements of standard costing are there, including what is perhaps the first references to "management by exception.[49]

Two different methods of determining production costs have been mentioned—the old way using *ex post* figures and the "modern approach" using *ex ante* figures. The standard costs were developed by "standardizing the efficiency of men, machines, materials and methods, rather than the cost of the work;'[50] they could be viewed as evolving from the standardized job concept (implying equalized rates and uniformity of the basis for setting the rates) as developed through scientific management.[51]

Scientific management developed physical standards, especially for labor time, and used comparisons of standard and actual times to determine bonuses. It also urged the reporting of failures to meet the standards to appropriate managers. In these respects, it did tie in with standard cost variance analysis procedures. It did not appear, however, to state these variances in monetary terms nor to calculate variances.

The accounting systems described by Taylor, while being very complete, did not incorporate the variances developed in the reports into the accounts.[52] The systems closely resembled the "normal" cost method of actual prime costs and predetermined overhead rates.

Emerson, who strongly advocated the idea of a forward looking approach to cost determination, felt that the old methods did not reduce waste due to the untimeliness of the data and the possible inclusion of irrelevant costs. The modern method, on the other hand, provided a means by which losses due to inefficiency could be measured and ways of diminishing such losses developed.. He also felt that standard costing should be introduced before scientific management so that the accounting system would be ready for the input of the industrial engineer and could aid him in evaluating the success of his work.[53] This was a view somewhat contrary to Taylor's later thoughts. The same idea was expressed by de Haas:

> The introduction of a system of standard costs is in no way dependent upon the existence of any particular kind of internal organisation. It does not presuppose scientific management, in fact it may almost be stated axiomatically that it should preceed the introduction of scientific management.[54]

While these authors are saying that a firm can have standard costing without adopting the philosophy of scientific management, they are not precluding the need for a close cooperation between the cost accountant and the industrial engineer. Taylor, himself, felt that any accounting system could be adapted to handle the piece work records and reports required for scientific management.[55]

Conclusion

A direct relationship between scientific management and standard costing is not clear. The literature on scientific management does refer to the need for good cost data, accounting records, and reports to ensure that the desired efficiency is being attained, but the concept of a "standard cost" is not obvious. The same holds true for the literature on standard costing. The use of industrial engineering techniques for the determination of the physical standards is acknowledged, but such techniques are not related back to the philosophy of scientific management in many cases.

Inasmuch as scientific management is a philosophy rather than a system, it appears more likely that standard costing evolved from the estimated cost systems that existed, with industrial engineering techniques providing the "more scientific and accurate" methods of estimation. Estimated cost systems did develop variances from the estimates; such variances, however, did not separate out the price and efficiency components. The reports prepared for a scientifically managed enterprise looked specifically at the efficiency side, but in nonmonetary terms; this is still an acceptable approach for reports submitted to lower levels of factory management. Also, scientific management did improve the types of reports received by management with the adoption of the concept of management-by-exception; however, variances from plans can be developed and reported without standard costs, e.g., variances from the budget.

While one cannot say whether standard costing would have developed without the influence of the scientific management movement, the philosophy of scientific management, especially as implemented in the factory, had a great influence on the timing of its

development. The early comments regarding estimated costs show that the ideas of standard costing were evolving, but the great awareness of the need for measures of efficiency created by the adoption of the principles of scientific management expedited the evolutionary process.

FOOTNOTES

[1]See, for example: Solomons, 1952B; Sowell, Ch. IV; and Chatfield, Ch. 12.
[2]Harrison, 1924, p. 193.
[3]Kearsey, p. 5.
[4]Jaffe, p. 267.
[5]See, for example, Epstein.
[6]See Sowell, Chs. II and III.
[7]Sowell, p. 20, emphasis added.
[8]Sowell, pp. 30-31.
[9]Sowell, p. 38.
[10]Solomons, 1952B, pp. 38-39.
[11]Sowell, p. 51.
[12]Sowell, p. 52.
[13]Sowell, p. 121.
[14]Sowell, pp. 52-53.
[15]Sowell, p. 194.
[16]Kearsey, p. 1.
[17]Kearsey, p. 2.
[18]Kearsey, p. 4.
[19]Solomons, 1952A, p. 458.
[20]de Haas, pp. 30-31.
[21]Aitken, p. 16.
[22]Harrison, 1920, pp. 237-238.
[23]Harrison, 1924, p. 132.
[24]Spriegel and Myers, p. 79.
[25]Drury, p. 71.
[26]Simeon, p. 68.
[27]Harrison, 1927, p. 193.
[28]Taylor, 1911, p. 126.
[29]Simeon, p. 68.
[30]Taylor, 1967, p. 39.
[31]Church, p. 98.
[32]Church, p. 100.
[33]Boyd, p. 406.
[34]Copley, Vol. I, p. 363.
[35]Sowell, p. 148.
[36]Aitken, p. 114.
[37]Aitken, p. 114.
[38]Aitkenson, p. 370.
[39]Copley, Vol. I, p. 369.
[40]Copley, Vol. I, p. 369.
[41]Copley, Vol. II, pp. 142-143.
[42]See Taylor A and B.
[43]Copley, Vol. I, p. 367.
[44]Copley, Vol. I, p. 367.

[45]Castenholz, pp. 82-83.
[46]Castenholz, p. 81.
[47]Castenholz, pp. 84-85.
[48]Emerson, pp. 198-199.
[49]Solomons, 1952B, pp. 39-40.
[50]Sowell, p. 211.
[51]Goudey, p. 217.
[52]See Taylor A and B.
[53]Harrison, 1924, p. 43.
[54]de Haas, p. 32.
[55]Copley, Vol. II, p. 144.

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