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SOME INFLUENCES ON THE DEVELOPMENT OF COST ACCOUNTING

Abstract: The influence of engineers on the development of cost accounting in the closing decades of last century has been well recognized. The influence of economists, the retarding effects of an obsession with industrial secrecy, and some curious effects of competition and the lack of it have not been fully explored. These matters are examined in this paper, together with some of the consequences of the efficiency movement, as seen in the costing system developed by Alexander Hamilton Church. The strengths and weaknesses of present-day cost accounting are related to this early period of development.

Attempts to calculate the cost of production before the Industrial Revolution have been well documented and illustrated.¹ Of course, they are not generally regarded as being "cost accounting". That title is normally reserved for integrated cost and financial accounting systems which involve the allocation of indirect and fixed expenses. It is therefore assumed to be applicable only after the Industrial Revolution when those expenses were of such a magnitude that they could no longer be ignored. We cannot, however, claim that cost accounting arose as a direct consequence of the Industrial Revolution. That is too simple an explanation. Extensive organizations (and therefore indirect expenses) were a feature of the putting-out system, and large factories (and therefore fixed costs) were not uncommon before 1800.² The problem of calculating the cost of production, including the allocation of indirect and fixed expenses, therefore existed well before the Industrial Revolution but, curiously, little interest was taken in it by manufacturers and businessmen until well after the revolution was complete.³ More curious, perhaps, was the lack of interest shown by accountants. There is nothing in the literature of accounting to indicate any deep or continuing interest in cost accounting as we now know it prior to 1970,⁴ and even into this century the nature and effects of fixed costs were not widely recognized.⁵

This article is adapted from a paper given at the Second World Congress of Accounting Historians, Atlanta, 1976.

That various ways of allocating overhead and other fixed costs to products were in use by the 1870's is evidenced by a book which contains a detailed list and criticism of six methods "seen in use by the author", Thomas Battersby, a Manchester public accountant. But Battersby's book appears to have aroused no interest. It is not mentioned in any of the professional journals of the day. Ten years later, although they covered the same subject matter, the books of Garcke and Fells and A. J. Liversedge were both said by their authors to be the first book to deal with factory or engineers' cost records.

Although the methods described by Battersby were relevant only after a substantial increase in the amount and extent of fixed costs had occurred, those methods were not widely advocated or discussed until well after the rise in the level of fixed costs had taken place.⁶ The existence of fixed costs, does not, therefore, by itself explain the interest taken in cost accounts only towards the close of last century. Conversely the lack of any public discussion of the advantages to manufacturers of maintaining detailed cost records may be explained quite easily.

INDUSTRIAL SECRECY

The reason most frequently given for the lack of expositions dealing with cost accounting prior to 1870 is the attitude of British industrialists to their financial records. Edwards' reference to the "tradition in the British business world that as little as possible should be disclosed" is typical.⁷ Pollard disagrees:

It is sometimes suggested that secrecy was deliberate to avoid giving away advantages in accounting practice or in the business practice it described, but, with the possible exception of the chemical industries, such secrecy was not observed in the technical field itself, where it might have been more to the point.⁸

Pollard's view appears to be questionable. He had referred previously to the secrecy which allowed wide variations in salary and conditions of employment of managers to exist even within narrow geographical areas, and to the variations in the speed with which firms adopted new accounting procedures.⁹ The views of writers of the time confirm that, irrespective of the manufacturers' attitudes to technical matters, financial affairs were closely guarded secrets. In 1785, for example, the secrecy "to which every manufacturer has a natural right" was claimed as a good reason for opposing Pitt's

scheme to introduce an excise tax on coal.¹⁰ The attitude towards secrecy obviously persisted until the end of the nineteenth century:

. . . we all know that to the producer nothing is more sacred than his cost sheet, and it is not easy for an outsider to get frank and accurate statements of this class.¹¹

One contributor to the *Engineering Magazine* in 1900 saw secrecy to be relatively less common in America than in England. In an article entitled "The Policy of Secretiveness in Industrial Works" he stressed the conventional view:

. . . is it not true that secrecy is, according to the generally accepted European idea, the key to success in manufacturing?¹²

Some manufacturing firms appear to have gone to extraordinary lengths to maintain secrecy:

. . . it is the custom to add a further percentage to the actual oncost, which amount is known only to the management, so that the office staff may not see the profit made on each job.¹³

British accountants, it seems, were well aware of the effects of such an obsessive concern with secrecy. Mann cited it as the reason for rival firms refusing to disclose details of their systems.¹⁴ The editor of *The Accountant* considered it to be the cause of the 'backward state of Cost Accounts,'¹⁵

Whatever the cause, the systems in use in English factories were seldom described in the literature prior to 1914 (or since). In fact, in an extensive search of the literature I found only four examples in which the firm was actually identified.

COMPETITION

The boom from 1866 to 1873 not only doubled railway mileage but initiated new services, new machinery, new forms of business organization, opened up new areas, and sucked in a vast amount of new capital into the American economy.¹⁶

The period 1873-96 is usually known as the Great Depression. It was marked by more severe fluctuations in economic activity than had occurred during the previous quarter of a century and by an intensification of industrial competition.¹⁷

The reason most commonly given for the upsurge in publications on cost accounting after 1870 is that the demand for information on cost systems was in response to the increased level of competition which affected both Britain and America. Littleton, Solomons, Garner and Pollard all make reference to the effects of competition, and they are well supported by the literature of that time and later.¹⁸

There can be little doubt that a period of intense competition was experienced, particularly in Britain, in the closing decades of the nineteenth century. For the engineering trades, it was a relatively new experience. Many American engineering methods had, for the first time, overhauled and surpassed those used in Britain.¹⁹ Whereas previous periods of depressed economic conditions had not led to any drastic slackening in demand for engineering products or machines, the "Great Depression" was so prolonged, and its effects so widespread, that all branches of trade were affected.²⁰

If costing systems could be seen to aid manufacturers in setting prices and in improving the efficiency of their operations, then the intensely competitive conditions existing just prior to 1900 may well have provided a climate in which proposals for the introduction of those systems would have been more readily accepted. The claim of a cause and effect relationship between increased competition and the introduction of costing is, therefore, intuitively appealing. It does not, however, explain why the principal developments occurred in America and not in Britain; nor why the main advocates of costing were mechanical engineers and not civil engineers, builders, or process manufacturers; nor why the total cost per unit of product was advocated in preference or in addition to departmental costs and to the exclusion of direct or marginal costs.

The American Mechanical Engineers

The contribution of engineers to the development of cost accounting has been widely recognized. Edwards, Solomons, Garner and Chatfield have all paid tribute, in general terms, to engineers for the interest they took in developing costing techniques. Barton, Chapin, Parker and others have described the derivation of cost-volume-profit charts and their relationship to engineers' cost and output graphs. But none of those authors has explained the role of the American Mechanical Engineers in particular in advocating and publicizing the need for cost records. To understand the interests of the American Mechanical Engineers, it is necessary to go back to the origins of the New York based society.

The inaugural meeting of The American Society of Mechanical Engineers (ASME) was held in New York on April 7, 1880. Almost immediately its members took an interest in commercial as well as engineering affairs. Thurston, later to become Director of Cornell University's Sibley College, demonstrated this awareness when he delivered a paper to the Society in 1882 on the costs of operating engines of various sizes. Other papers on costing followed in 1885, 1886 and 1888 which in 1893 comments were invited under the heading of "Cost of Manufacture", and several members responded.

Another feature of the interest in commercial matters was the close association between the mechanical engineers and the journals *American Machinist* and *Engineering Magazine*. The formation of the A.S.M.E. was actually first proposed by Jackson Bailey, editor of the *American Machinist*, in 1879.²¹ The first volume of *Engineering Magazine* was published in 1891. The 5th number included an article on bookkeeping, and nearly one hundred articles on cost and related subjects appeared over the years to 1914. In 1901 an entire issue (Volume 20, Number 4) was devoted to "shop management". These journals, more than any other publications, fostered an interest in cost accounting and machine shop efficiency, and together with the small group of engineers based in and around New York were the first to take a close interest in cost recording systems.

Calvert has described the unique collection of men who gathered in New York in the 1880's under the auspices of the A.S.M.E.²² They were the "elite" of the mechanical engineers. They were, primarily, profit oriented. They measured "all things by the test, will it pay?"²³ Their particular interests and commercial environment provided the setting in which the advocacy of costing was to flourish.

Contrary to the common view that competition provided the stimulus to the introduction of costing systems, a notable feature of the American mechanical engineers' in the mid and late eighteen-hundreds was the lack of competition. The owners of machine shops were said to have had "close business and social relationships with their customers". The association was, therefore, a personal one based on the "customers" faith in a particular shop's ability to solve their mechanical problems.²⁴ There was not, accordingly, any overt competition between mechanical engineers. On the contrary, a "shop culture" developed which had all the hallmarks of a "gentlemen's club".²⁵ Within the club, information was freely shared. The result was "a vast, mutually owned store of knowledge and experience closely akin to a body of scientific knowledge".²⁶

Calvert's description of the origins of the elitist A.S.M.E. is borne out by the nature of the papers and discussion at its meetings. Papers dealing with costing invariably described a system actually in use. One of the early papers delivered to the society described the system installed at the U.S. Naval Ordnance Department by Captain Henry Metcalfe (1886). Frederick Taylor, later to become famous for his advocacy of "scientific management", was particularly interested as he had "had experience during the past ten years, of organizing a system very similar" at the Midvale Steel Company's works.²⁷ Subsequent papers, and articles in contemporary American journals followed the same format. They provided intimate detail of the systems installed in well-known machine shops. Of the companies whose systems were described in the literature between 1880 and 1914, thirty-nine were American, only four were English. With few exceptions, the American descriptions were by members of the A.S.M.E.

The Efficiency Movement

The particular circumstances of the American Mechanical Engineers had another consequence. In the first decade of this century the drive for efficiency swept through American industry. Like the earlier descriptions of cost records, it emanated primarily from the A.S.M.E.

At first the movement was directed solely at physical efficiency. Its origins are clearly discernible in various wage schemes designed to provide some control over the activities of workers and to provide some incentive for them to increase their output. Once again, the methods used in the U.S. made the later adoption of cost records easier than was the case in Britain. The difference lay in the piece-rate and gain-sharing schemes compared with the form of profit-sharing commonly found in Britain. The former required detailed records of the physical output of each worker, whereas the latter related only to some general calculation of total profits.²⁸

In line with the emphasis on the physical output of workers, the efficiency movement was originally directed at physical efficiency. The best known advocate of the system was Frederick Taylor. (The system was, in fact, frequently referred to as the "Taylor System"). His basic proposal was that each workman be given a set task each day. If the workman completed the task in the specified time, he received an "addition of from 30 per cent to 100 per cent to his ordinary wages".^{28a} The transition from physical to monetary standards followed, somewhat naturally, when the workers with

monetary responsibilities were brought within the scheme. Thereafter the two ideas — efficiency and cost records — became so closely associated that they were commonly regarded as being part of the same system.²⁹ The transition was further hastened when the drive for physical efficiency gave way to a drive for economic efficiency:

. . . The progress of last century was almost wholly in the direction of promoting technical development, leaving to us of the present day, the almost equally interesting task of increasing economic efficiency.³⁰

Alexander Hamilton Church was recognized as one of the early experts in cost records and is widely recognized as one of the pioneers of modern cost or management accounting.³¹ It is instructive to consider the system developed by him in more detail.

The Church System

The system described by Church was dependent upon a carefully designed organization structure. His aim was to facilitate managerial control of the organization by dividing the factory into a series of “little shops”. The foreman of each “shop” was charged with all the direct costs for which he was responsible, plus a fair proportion of the general factory overhead. The allocation was to be based on the average or normal running time of the machine or the normal time worked by the direct labour of the “shop”.

The system described by Church had some additional features including a “supplementary” rate and the allocation of office and selling expenses. We will concentrate, however, on the main features of the system as described above. The features were common to virtually all of the systems described or proposed prior to World War 1, and Church was, in that sense, representative of his contemporaries.

American engineers, concerned as they were with job ordering, had a particular interest in unit costs not common to the process manufacturers. Each unit of output of the mechanical engineer was unique. It was manufactured according to specifications to fulfill a particular function in a particular setting. Each job had to be quoted for separately. Expected total costs were therefore spread over the expected output in the hope that the charge-out rate so established would allow all the costs of the establishment to be recovered during the forthcoming period. Here, clearly, are the origins of what is now commonly referred to as “absorption costing”.

None of the circumstances of the American mechanical engineer was, by itself, unique. But together, those circumstances—the concentration in, or near to New York of a group with a common interest and background; the lack of secrecy and competition; and the presumed need to calculate unit costs—provided the environment in which descriptions and discussions of costing methods were to become widespread.

It is also important to note that, initially at least, the American engineers lay outside the three streams of accounting which Pollard considers preceded cost accounting.³² The engineers were not, in fact, concerned with accounts at all. Their references were all to “cost records”. Those records were not necessarily double entry, or connected with the firm’s general accounting system. They were seen, rather, as something designed and maintained by the engineer. They could not be left to “business men” or clerks and accountants only.³³

Notably, Church and his contemporaries were extremely vague about the purposes to be achieved by their costing systems. It was evident that the mechanical engineers had been interested primarily in developing a system which would enable them to set prices which would, in the aggregate, cover their costs.³⁴ Hence the proposal to allocate *all* costs to production.

With the advent of the efficiency experts, the emphasis shifted to control.³⁵ But the basic system remained unchanged. Herein lies the reason for the defects still found in cost accounting systems in use today. They are basically incapable of achieving the purposes claimed for them. I have argued elsewhere that any system which requires that overhead costs be allocated to products and/or departments cannot provide a basis for judging which product is most profitable, whether the production process is being operated efficiently, whether there has been “preventable waste”, or what the income for the period has been. The arguments in support of these claims need not be repeated here. What is interesting, however, is that the purposes just described were taken directly from one of Church’s most widely known publications.³⁶ They correspond closely with the purposes listed by Horngren in his widely used textbook.³⁷ The connection between modern cost accounting systems and those developed by engineers around the turn of the century is clear and direct.

The Economists

Less influential were the economists who wrote during or prior to the period in which cost recording systems were being de-

veloped. References to economists by accounting or engineering authors are sparse indeed.³⁸ This omission is curious in view of the fact that the few references by accounting authors of the time suggest that they were not entirely ignorant of the economic literature.

Despite the lack of any direct association between cost accounting and economic doctrine, an indirect influence is clearly discernible. The classical economists of the eighteenth and early nineteenth centuries developed a labour theory of value which was based on the notion that wages paid to labour became embodied in the goods produced.³⁹ Ricardo extended the theory from that of strictly a labour theory to a "cost of production" theory.⁴⁰ In that guise it bears a remarkable resemblance to the "costs-attach" notion which is the basis of the costing systems developed towards the end of last century, and still common today.⁴¹

Another consequence of the lack of contact between accountants and economists appears to have been that accountants generally remained ignorant of the marginalist school of economics. As a result, the accountants proceeded to embrace the "costs-attach" notion at the very time it was being brought into question and rejected by some prominent economists.⁴² Even those accountants who can not have been ignorant of the changing tide in economics chose, apparently, to ignore it. Garcke and Fells provide a classic example. They referred to *The Economics of Industry* by A. and M. P. Marshall on some peripheral matters. They ignored a passage in which the Marshalls describe a decision-process involving costs of production. In that passage, the Marshalls make clear the view that prices are not dependent upon costs and that total, not unit, costs are relevant for decision-making. The analysis in Garcke and Fells directly contradicts that of the Marshalls. Garcke and Fells argue that all costs other than establishment expenses and interest on capital should be allocated to units of production for the purposes of controlling employees and setting prices.

The Problem of Railway Rates

Similar to the general ignorance referred to above, was the lack of interest shown by accountants in the debate over how railway rates should be set. As early as 1850, Lardner had separated the two problems—of reviewing progress and of setting rates. For the latter he suggested identifying the costs of each class of traffic, recognizing that in some cases an arbitrary allocation would be necessary. Towards the end of the century, however, railway eco-

nomists were almost unanimous in the view that it was impossible to ascertain the full costs of different classes of traffic and therefore impossible to use costs as the basis of rates:

. . . it is impossible to determine the cost of each [class of traffic], and therefore manifestly impossible to predicate schedules of rates upon cost.⁴³

Not surprisingly, those concerned with the economics of railway operations accepted readily the notion of marginal costs and a contribution margin. In 1888 Mordecai argued that as the general expenses were "indivisible per unit", the difference between receipts and the cost of working went "towards paying the fixed charges".⁴⁴ In 1891 Acworth, a prominent writer on railway affairs, placed the discussion in its proper context:

A further practical point may also be noticed. Rates must be fixed in advance. It is only afterwards that cost can be even approximately known.⁴⁵

We cannot claim that the railway rate debate had any direct bearing on the development of cost accounting. Yet it seems inconceivable that accountants, particularly in the U.S., were unaware of the debate which culminated in the Interstate Commerce Commission being given the power to set rates through the effects of the Commerce Court Act of 1910. But whether accountants were aware of it or not, it received no publicity in accounting journals of the time. Similarly, the fact that the problem was the same as that found in relation to manufacturing activities generally was not recognized by accountants until much later, despite some pointed reminders:

We learned first that a railroad is not like a soap factory; the next step was to learn that a soap factory is more or less like a railroad, and that the things we thought peculiar to railroads are, in fact, wellnigh universal.⁴⁶

Belated Recognition

There is good reason to suppose that the concern to maintain secrecy of the accounting records hampered the development and dissemination of cost accounting ideas and practices in Britain. Conversely, the openness of the American mechanical engineers provided the environment in which those ideas and practices flourished. It is also interesting to note that, contrary to the view most commonly held, it was the lack of competition amongst the

American engineers that, initially, encouraged them to discuss costing methods. Only later did competitive pressures lead to the almost obsessive concern with efficiency and to the development of uniform systems of accounting. A highly developed example of the resulting system was described by Church. It was probably well ahead of its time, and there is no evidence to suggest it enjoyed widespread adoption at the time. Nevertheless, all of the ideas presented by Church and other efficiency experts, as well as those of economists, are now commonplace in the literature of accounting. Just what role the various groups played in getting their ideas accepted, or at least considered, by accountants, we cannot say. Nor can we explain the extraordinary lags which appear to have occurred between an idea appearing in the engineering or economics literature and its adoption by accountants.

Also of direct relevance to accounting practices were the arguments of the economists in the railways rate debate. It is to be regretted that accountants did not follow, and adopt, the proposals presented there. That accountants failed to do so should not, however, be surprising. The economists did not win that debate either.

FOOTNOTES

¹See, for example, Edwards [22] pp.225-31; Garner [25] pp.1-26; Solomons [51] pp.6-8; de Roover [48] pp.50-68.

²Pollard, pp.9, 24.

³The Industrial Revolution cannot be given precise dates, nor, in a sense, can it be said to have been completed — it is still going on. However, in the sense that the switch to powered machinery and the advent of large factories was well established the period 1770-1820 can be identified as that of the revolution. Edwards [22] p.193-4; Pollard [45] pp.61-103.

⁴Edwards [22], commented that the notable feature of the literature after 1870 was the attention given to overhead and other fixed costs (p.343), whereas prior to that time such publications were conspicuous by their rarity (p.225).

⁵One correspondent in *The Accountant* ([46] p.566) in 1907 even suggested that the term 'fixed' should not be used because it implied that those costs could not be averaged!

⁶Ricardo [47] commented in 1821 on the use of improved machinery and its effect on capital employed (p.271). Deane and Cole [20] p.191 give some statistics on the increase in capital employed, while Hicks [26] pp.142-3 emphasizes the increase in the '*range and variety of the fixed capital goods in which investment was embodied*'.

⁷Edwards, p.283.

⁸Pollard, fn.1, p.215.

⁹Pollard, pp.139, 215.

¹⁰Ashton, p.165.

¹¹Kirchhoff, p.353.

¹²Outerbridge, p.862.

¹³Jenkinson, p.323.

¹⁴Mann, p.260.

¹⁵*The Accountant*, August 27, 1904, p.214.

¹⁶Armytage, p.171.

¹⁷Barker and Harris, p.433.

¹⁸Littleton, p.321; Solomons, p.18; Garner, pp.28-29; Pollard, p.245.

¹⁹Burn, p.292; Calvert, p.108.

²⁰Checkland notes that earlier in the century: 'The millowners, having involved themselves in costly plant and equipment, could not afford in a competitive situation, to contract output in order to keep prices up. Indeed, capacity actually increased, for spinners, in the attempt to improve their individual positions, built weaving sheds and installed power looms' ([14] p.17). These effects are clearly evident in tables of prices of the nineteenth century. Whereas depressions appear to have affected only limited sections of the economy (for example agricultural products, or textile products) earlier in the century, all prices suffered drastic declines in the depression of 1873-1896. See Mitchell [41] pp.472-473.

²¹Calvert, p.110.

²²Calvert pp.114-122.

²³Coleman Sellers, President of A.S.M.E., 1887. Quoted by Calvert [11].

²⁴Calvert, p.6.

²⁵Calvert, p.111.

²⁶Calvert, p.7.

²⁷Taylor, p.475.

²⁸This is not to suggest that piece-rates were unknown in Britain. The putting-out system frequently operated on piece-rate payments, and the system was also carried over into factories (Ashton [4] p.283).

^{28a}Taylor, p.39.

²⁹Hence books with titles such as *Cost Keeping and Scientific Management*, Evans [23]; *Science and Practice of Management*, Church [17]; wherein the authors make clear the direct association, as they see it, between 'costing keeping' and 'scientific management'.

³⁰Church, 1911, p.991.

³¹Both Garner [25] and Solomons [51] acknowledge Church's contribution. Solomons also quotes Roland Dunkerly 'a former President of the Institute of Cost and Works Accountants' who said of Church that he 'probably did more than anyone, both directly and indirectly, to promote costing as it is now known, chiefly because he promoted thought' (Solomons [51] p.24).

³²These were described as 'the master and steward system . . .; the mercantile system . . .; and the accounting developed by manufacturers operating the putting-out system'. Pollard [45] p.209.

³³Towne, 1885, p.429.

³⁴Papers delivered at meetings of the A.S.M.E. in 1896 [31] and 1897 [32] by Lane are typical. Both were entitled, in part, 'A Method of Determining Selling Price' and emphasized that as the object of cost records.

³⁵In a few words, the purpose of costs is twofold: The first is to furnish cost of the products so that the selling price can be fixed, or if the selling price is fixed by competition, to determine if the product can be manufactured at a profit. The second is for the benefit of the manager, to show him where economies may be affected (Evans [23] p.23).

³⁶Church, 1909, p.185.

³⁷Horngren, p.xvii.

³⁸I have found only nine instances up to 1914. See for example Garcke & Fells [24], Branford [9], Mann [36], and Cowan [19].

³⁹See for example, Smith [50] Vol. 1, p.351, and Marx [39] pp.199 & 410.

⁴⁰See Ricardo [47] p.30 and Senior [49] p.98.

⁴¹The point was made clearly by an anonymous author in *The Author* in 1905: Labour goes directly or indirectly into the product in the factory. There appears to be no good reason why it should not follow the same course on the books in the office ([2] p.232).

⁴²For a description of the influence of the marginalist school, see Parker [44] pp.17-18.

⁴³Kirkman, Vol. 1, p.306.

⁴⁴Mordecai, pp.65-6.

⁴⁵Acworth, p.52.

⁴⁶Clark, 1914, p.749.

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