

1971

Manufacturing Accounting in New England Textile Mill, 1856-1910

H. Thomas Johnson

Follow this and additional works at: <https://ir.lib.uwo.ca/economicsresrpt>

 Part of the [Economics Commons](#)

Citation of this paper:

Johnson, H. Thomas. "Manufacturing Accounting in New England Textile Mill, 1856-1910." Department of Economics Research Reports, 7101. London, ON: Department of Economics, University of Western Ontario (1971).

RESEARCH REPORT 7101
MANUFACTURING ACCOUNTING IN A NEW ENGLAND
TEXTILE MILL, 1856-1910

by

H. Thomas Johnson

For invaluable assistance, I wish to thank Mr. Robert Lovett and Mrs. Eleanor Bishop of the Manuscripts Division, Baker Library, Harvard Graduate School of Business Administration. I also want to thank the staff of the Merrimack Valley Textile Museum, North Andover, Massachusetts, for answering my many questions about textile manufacturing processes. The research for this project was made possible by a grant from the Canada Council.

February, 1971

MANUFACTURING ACCOUNTING IN A NEW ENGLAND TEXTILE MILL,
1856-1910

I

One aspect of modern business history that scholars have all but ignored is the development of industrial cost accounting as a management tool since the late nineteenth century. Indeed, we know more about the cost practices of a few business firms before 1800 than of any industrial firm after 1870. No doubt this gap in the literature exists because most historians are not trained to do research in modern accounting records. Although there are several studies on modern cost accounting history written by professional accountants, these accounting historians have dealt exclusively with the general bookkeeping problems that had to be surmounted to adapt double-entry mercantile accounting to the needs of a factory production system. Their conclusions are not based on research in actual company records, but are drawn largely from management publications and accounting handbooks published around the turn of the century. Consequently, these studies by accounting historians do not reveal how late nineteenth century industrial firms pioneered the accounting innovations which later were generalized in textbooks and industrial management publications.¹

This article describes the manufacturing accounting system used by one industrial firm, a New England cotton textile mill, from 1856 to about 1910. A number of inferences and conclusions are drawn about how the cost data derived from this system were used for management control purposes. An understanding of basic cost accounting is essential, however, before one turns to the textile company records. Therefore, the next section will describe the main elements of modern cost accounting and will compare it with the state of the art in the late 1800's as described by accounting historians.

II

The development of cost accounting during the late 19th and early 20th centuries cannot be outlined without reference to the flow of cost data in modern manufacturing income statements. Especially important is the modern notion that not all manufacturing costs incurred during the year are charged against current income. Only those costs assigned to goods actually sold are charged to expense in the current period. Costs that are not related to goods sold generally remain on the books at the end of the period as assets (unexpired costs) in the form of inventory balances. The basic relationship between these expired and unexpired costs is readily shown if we let

U_o = unexpired costs from the prior period in opening inventory,

A = additions to cost during the current period,

U_c = unexpired costs of the current period in closing inventory,

C = costs transferred during the current period.

It follows by definition that $U_o + A = U_c + C$. As shown in Chart 1, this relationship is used to calculate cost transfers (C) in three crucial parts of a typical manufacturing firm's income statement. Thus, opening and closing inventory balances and current additions to cost are used to calculate the cost of raw material that is put into production (\$50,000), the cost of goods that are manufactured and transferred to finished stock (\$70,000), and the cost that is charged to current expense for goods that are sold (\$78,000).

One function of a cost system is to provide reliable estimates of inventory balances (U_o and U_c) and cost transfers (C). These estimates can be accounted for by one of two bookkeeping methods, manufacturing accounting or cost accounting. The bookkeeping procedures used for these two cost systems can be described by referring to the general ledger accounts that are shown

CHART 1

XYZ Manufacturing Company
Income Statement
Year Ended December 31, 1971

Net sales		\$ 100,000
Less cost of goods sold -		
Work in process inventory, January 1	\$ 10,000	
Cost of material added to production -		
Raw material inventory, Jan. 1	\$ 5,000	
Material purchased in 1971	51,000	
Raw material inventory, Dec. 31	<u>-6,000</u>	50,000
Labor and other manufacturing costs added to production	25,000	
Work in process inventory, Dec. 31	<u>-15,000</u>	
Cost of goods manufactured (finished)	\$ 70,000	
Finished goods inventory, January 1	20,000	
Finished goods inventory, December 31	<u>-12,000</u>	<u>-78,000</u>
Gross profit on sales		\$ 22,000
Non-manufacturing income and expenses, including income taxes		<u>-10,000</u>
Net income		<u><u>\$ 12,000</u></u>

in T-account form in Chart 2. The following descriptions of manufacturing accounting and cost accounting are very simplified and are intended only to highlight their basic differences.²

In manufacturing accounting, cost transfers are arrived at indirectly by deducting ending inventory balances from the sum of opening inventories plus cost additions ($C = U_o + A - U_c$). The unique feature of manufacturing accounting is that the cost of goods manufactured and cost of goods sold, \$70,000 and \$78,000 respectively in Chart 2, cannot be determined until the ending inventories of work in process and finished goods are estimated. Furthermore, these inventory balances are not determined directly in the accounting records, but are gotten only by physically counting all finished and in process goods and estimating their costs at the end of an accounting period. Therefore, with a manufacturing accounting system, a time consuming physical inventory is required whenever data on manufacturing costs are required. Once these inventory balances are determined, however, the cost transfers from the manufacturing expense and cost of goods sold accounts are arrived at by deducting ending inventory from the total charged to each account for opening inventory plus cost additions. The ending inventory balances remain, of course, in the accounts as the opening inventory balances of the next period. With regard to the manufacturing expense account, cost additions are transferred to it from various sub-accounts for material, labor and manufacturing overhead. These cost additions do not have to be entered in the manufacturing expense account until the end of the accounting period when the physical inventory and cost transfer are determined. Manufacturing accounting, although widely used in the early 1900's and still used by many small firms today, is not a very satisfactory system for cost control since it does not provide timely data on total and per unit costs.

CHART 2

Basic Ledger Accounts in Cost Systems
(Amounts from Chart 1)

Manufacturing Accounting -

Manufacturing Expense		Cost of Goods Sold	
<u>1971</u> Jan. 1	Work in process inventory 10,000	<u>1971</u> Jan. 1	Finished goods inventory 20,000
Dec. 31	Material, labor and other costs added to production 75,000	Dec. 31	Cost of goods sold (to profit and loss) 78,000
	<u>85,000</u>		<u>90,000</u>
<u>1972</u> Jan. 1	Work in process inventory 15,000	<u>1972</u> Jan. 1	Finished goods inventory 12,000

Cost Accounting -

Work in Process		Finished Goods	
<u>1971</u> Jan. 1	Work in process inventory 10,000	<u>1971</u> Jan. 1	Finished goods inventory 20,000
Dec. 31	Material, labor and other costs added to production 75,000	Dec. 31	Cost of goods sold (to profit and loss) 78,000
	<u>85,000</u>		<u>90,000</u>
<u>1972</u> Jan. 1	Work in process inventory 15,000	<u>1972</u> Jan. 1	Finished goods inventory 12,000

A more satisfactory system, known as cost accounting, accounts directly for inventory balances and cost transfers. In a true cost accounting system, charges from opening inventories and from costs added during the period flow through the accounting records in unison with the time path of production from the raw material stage to the finished goods stage. In terms of the equation above, cost accounting utilizes the relationship $U_c = U_o + A - C$. Subsidiary production records keep track of the physical production flow and provide the basis for cost transfers into and out of the work in process account. Ending inventory balances are therefore derived by deduction after the relevant cost transfers are made from the work in process and finished goods accounts. Because physical inventories are not needed, manufacturing cost data are available directly from the accounting records at any time. A cost accounting system can therefore provide more timely and more accurate data on unit costs and can offer better cost control than a manufacturing accounting system.

Accounting historians have distilled from early bookkeeping manuals an outline of a very crude cost system which they believe was the precursor to manufacturing accounting that was most widely used by nineteenth century industrial firms.³ In this system, one general ledger "trading" account was used to accumulate the data shown in the two accounts at the top of Chart 2. The trading account also summarized all revenues and other expenditures to arrive at a profit and loss balance and made no distinction between manufacturing and non-manufacturing costs. Inventory balances in the trading account, usually valued by guesswork, often included only raw materials and finished goods but not work in process. Thus, many unexpired costs were charged against current income. Obviously, such records did not supply direct information on manufacturing costs, nor did they provide reliable profit and

loss data.

To most accounting historians, the main deficiency of this early factory accounting system was the failure of the bookkeeping process to distinguish between expired costs of the period and unexpired costs in inventory. This deficiency existed in large part because most accounting practitioners and writers in the eighteenth and nineteenth centuries were familiar only with mercantile bookkeeping principles. In mercantile accounting, which was based largely on the liquidation accounting practices of late medieval and early modern trading ventures, all expenditures were charged against current income. Nevertheless, early factory accountants, acquainted with no other method of accounting, applied mercantile principles directly to manufacturing situations. Mercantile bookkeeping had been designed, however, to account only for external transactions between the firm and outsiders, not the internal operations of a firm that also manufactured the goods it sold. Mercantile accounts were primarily records of assets and liabilities and were not intended to be an instrument of management control. Clearly, the conventional mercantile trading account was inappropriate for factory accounting because it was "...designed to deal with expenditures rather than costs and to show a calculation of final profit rather than the cost of manufactured goods."⁴

Modern bookkeeping for manufacturing costs developed only after accountants accepted the idea that double-entry ledgers could account for a firm's internal cost flows as well as its external market transactions. Once this idea was accepted, manufacturing accounting and cost accounting were developed as mechanical procedures which integrated external and internal "transactions" in the ledgers. It is widely believed that published works which describe manufacturing accounting first appeared during the 1880's. Manufacturing firms presumably began using such accounting only after that

date. One accounting historian described the transition from mercantile accounting to manufacturing accounting "...as an achievement second only to the original development of bookkeeping according to double-entry principles." He stated further that the adoption of modern cost systems in industrial practices marked "...the expansion of bookkeeping (a record) into accounting (a managerial instrument of precision)."⁵

Because their research focuses on general accounting publications instead of actual company records, accounting historians emphasize the bookkeeping problems that industrial firms had to overcome to develop proper industrial accounting procedures. But cost accounting and the use of cost data for management control purposes involve more than general ledger bookkeeping methods. It is hard to believe, therefore, that industrial accounting did not exist as "a managerial instrument of precision" before certain mechanical bookkeeping problems were solved. One might argue, of course, that modern manufacturing accounting or cost accounting could not have been widely used as tools for administrative decision making until there were simple and easily taught methods of integrating internal cost flows into the double-entry bookkeeping process. Nevertheless, scholars have provided a few examples of isolated entrepreneurs who, long before the 1880's, showed unusual insight in solving costing problems with data that were derived ad hoc outside the regular accounting ledgers.⁶ Unfortunately, we know almost nothing about actual costing methods developed by industrial firms during the crucial period of industrial growth between the 1870's and World War I.⁷ This knowledge is necessary if one is to understand properly how these firms dealt with problems such as pricing and capital budgeting. The literature supplied by accounting historians is a useful beginning, but insight into company practices will require a great deal of research in the records of many firms. As a preliminary

effort in that direction, the following section of this paper describes the manufacturing accounting practices of Lyman Mills, a New England cotton textile firm, from 1856 to about 1910. The financial records of Lyman Mills have been preserved in very complete form and offer an unusually good picture of late nineteenth century industrial accounting practice.⁸

III

The Lyman Mills Corporation was organized in Boston in 1854 and began operations with two water-powered cotton textile mills that had been constructed in Holyoke, Massachusetts during the late 1840's. For about twenty years, the company's product line consisted of "coarse" goods (e.g., standard sheetings, flannels and drills) that were produced in Mills No. 1 and No. 2. In 1872 the firm converted Mill No. 2 to the production of yarn and also constructed a new mill, Mill No. 3, which manufactured "fine" varieties of cloth (e.g., lawns, cambrics, silesias and organdies). The construction of Mill No. 3 in 1872 and a similar "fine" goods mill in the late 1880's suggest that Lyman Mills' growth strategy during the late nineteenth century was based on a rising market for high quality textile products.⁹ Opportunities for growth in sales of the coarser goods that they originally produced, and continued to produce, in Mill No. 1 were limited after the Civil War by the rising output of cheap fabrics from new mills in southern states.

The structural change in the type of goods produced by Lyman Mills can be seen by comparing the number of looms devoted to coarse goods and fine goods at various dates. Thus, Mill No. 1, which had about 620 looms producing coarse goods in 1856, had only 10 additional looms by 1878 and 120 additional looms by 1906. On the other hand, the number of looms producing fine goods rose from about 930 in Mill No. 3 in 1878 to over 1,600 in Mills No. 3 and 4 by 1906.¹⁰ The company's cost system, as will be seen below, grew more

complex and sophisticated as the number of fine good styles that were produced increased during the fifty years up to 1906. Many of the most important changes in the cost system occurred outside the basic ledger accounts. We can understand these changes better, however, after describing how the company handled manufacturing costs in the general ledger.

The bookkeeping procedure used by Lyman Mills to account for manufacturing costs was somewhat more advanced than the mercantile trading account system described above. In fact, as early as 1856, long before accounting historians assumed such systems were used, the Lyman books contained most of the elements of a manufacturing accounting system. The basic accounting records, for more than fifty years after 1856, included a double-entry general ledger and sub-ledgers kept by the Treasurer at the home office in Boston, plus a double-entry plant ledger with related expense and inventory ledgers kept by the Agent at the mill office in Holyoke. The ledger accounts were closed every six months to determine profit and loss. Reciprocal entries in the home office and plant ledgers were kept current via daily correspondence between the Treasurer and the Agent. The Holyoke plant ledger included numerous accounts for current assets, current liabilities and all operating expenses. In addition, costs of manufacturing were summarized in two accounts, one account for coarse goods output that was titled "Mill No. 1" and one for fine goods output, titled "Mill No. 2." The Boston general ledger included these same accounts as well as accounts for plant and equipment, capital stock, long-term liabilities and profit and loss. Sales of finished goods and non-manufacturing expenses were not entered in the plant ledger, but were recorded only in the "Mill No. 1" and "Mill No. 2" accounts of the home office general ledger.¹¹

From the standpoint of cost determination, the two mill accounts are

especially interesting. The T-accounts in Chart 3 show the flow of transactions in the general ledger and plant ledger "Mill No. 1" accounts during a typical six month accounting period. Similar entries were posted in the respective "Mill No. 2" accounts. The data in Chart 3 are from the company's books for the six months ending December 31, 1906, a period from which available records are very complete. The mill accounts were kept in similar fashion, however, from as early as 1856.

Raw cotton, labor and factory overhead were the three classes of manufacturing expense charged to the mill accounts. Labor and overhead comprised the smallest part of the total and were accounted for in the most direct fashion. Payments for payroll and overhead were charged from the cash journal to their respective ledger accounts and the balances transferred periodically (monthly or semi-annually) to the relevant mill account. The basis for distributing payroll charges between the two mill accounts was a record kept in each mill of employee hours, by day and by month, for each process in the mill (e.g., picking, carding, spinning, weaving, etc.).¹² Certain payroll charges, such as those for yard work, teaming, repairs and maintenance were transferred from the payroll account to relevant overhead expense accounts, from which they were transferred in turn to the applicable mill account. Overhead expenses were accounted for in similar fashion, although it is not clear how these were distributed between the two mill accounts.¹³ General expense distribution sheets that were prepared when the books were closed every six months suggest that several bases were used to distribute these expenses, and we might infer that these bases included such things as floor area, number of looms, and rated horsepower of water turbines in the various mills.¹⁴ It should be noted that the Lyman accountants did not expense unused materials and supplies such as coal, lubricants and starch. These

items were inventoried semi-annually and only the expired portion of expenditures for such items was charged to expense in the mill accounts.

The most important item of expense was raw cotton. At the time a contract was made to buy cotton, the contract cost (including estimated freight, insurance and other shipping charges) was charged to one of two accounts; one account (Cotton No. 1) for cotton to be used in coarse goods and another account (Cotton No. 2) for cotton to be used in fine goods.¹⁵ The cost of cotton used in production was transferred periodically from these cotton accounts to the respective mill accounts. The cotton cost transfer could not be determined, of course, until the books were closed at the end of each six month period, at which time an inventory was taken to determine the amount of cotton in transit, on hand, and in process up to the weaving stage. This raw cotton and cotton in process inventory, valued at cost on a first-in, first-out basis, was left in each cotton account as an asset balance.¹⁶ Once the inventory balance had been determined, the amount remaining in each cotton account represented the cost of cotton in goods that had been finished through the weaving stage in that six month period. That amount was transferred from each cotton account to the relevant mill account, as is shown by the \$296,950 cotton transfer in Chart 3.

Although the relevant cotton, labor and overhead charges were transferred periodically to the general ledger mill accounts, the data in those accounts were not compiled in order to determine the cost of goods manufactured. The general ledger mill accounts, by including additional entries for sales and non-manufacturing expenses, merely summarized final profit and loss figures without particular regard for manufacturing costs. These profit and loss figures, obviously of limited value to management for control purposes, were used primarily to determine the semi-annual dividends to shareholders.¹⁷ Thus,

if one looked no further than the general ledger, Lyman Mills' cost accounts would seem no more sophisticated than the hybrid factory-mercantile trading account that accounting historians depict as the precursor to modern manufacturing accounting.

A very different picture emerges, however, when one examines the plant ledger. The "reciprocal" mill accounts kept there were quite similar to the modern type of manufacturing expense account shown at the top of Chart 2, the main difference being that the plant ledger mill accounts did not include an ending inventory balance for work in process. This difference, however, is more apparent than real, especially with regard to the cost of cotton in partly finished goods. Note that the cost of cotton in goods still in process was left in the cotton account at the end of the accounting period. Thus, the cotton cost in Chart 3 of \$296,950 represented only the cost of cotton used in goods finished during the period. The unexpired cost of cotton in work in process was not charged to current expense. But the \$78,361 and \$42,855 charged to the mill account for manufacturing labor and overhead represented the total charges incurred during the period for those items, even though a portion of each amount should have been allocated to ending work in process. This failure to account properly for unexpired labor and overhead costs caused profits to be understated in one period and correspondingly overstated in the next period. The net distortion between years would have been small, however, since the amount of work in process did not change much from one period to another. Moreover, the cost of cotton, which was properly accounted for, was a larger component of total manufacturing costs than labor and overhead combined. The \$418,166 total charged to the plant ledger mill account was therefore a very close approximation to the "cost of goods manufactured" figure arrived at in a modern manufacturing

accounting system.

The records of Lyman Mills clearly suggest that the Treasurer and the Agent evaluated production performance with cost data from the mill accounts in the plant ledger. Evidence of this is the "cost of manufacturing statement," a pro forma summary of labor, cotton and overhead charges that was prepared from each mill account every six months, as far back as 1856.¹⁸ The statement for each mill account included: labor cost incurred in picking and carding, spinning, warping, and weaving; cost of cotton used in manufactured goods; and manufacturing overhead charges. The sub-totals for each of these three classes of expense, as well as the total of all expenses combined, agreed with the amounts charged to the respective plant ledger mill account. These semi-annual cost of manufacturing statements also gave a detailed breakdown of the items in overhead cost, such as starch, fuel, supplies, teaming, etc. Letters between the Treasurer and the Agent reveal several instances where the data supplied in these statements were used to evaluate overall plant/performance, to compare trends in production cost over time, and to assess the feasibility of new equipment or changes in plant layout.¹⁹ To aid in these analyses, the cost of manufacturing statements included data on the cost per pound and per yard of output for each major item of expense. Thus, Lyman Mills had developed a viable manufacturing accounting system long before such systems were described in accounting publications.

Another example of the company's efforts to gather meaningful data on production costs was the monthly cost of manufacturing statements that were prepared in addition to the semi-annual statements described above.²⁰ The monthly statements, which also go back to the late 1850's, included the same type of data as the semi-annual ones, except that the breakdown of overhead costs was not given. Information on actual labor costs was available for

these statements on a monthly basis in the payroll sub-ledgers. Actual cotton and overhead costs were not available, of course, until physical inventories were taken; normally the inventory occurred every six months. The total cotton and overhead costs included in the monthly manufacturing statements were therefore calculated by applying estimated costs per pound to the number of pounds of goods manufactured during the month. The last information was readily available from mill production records and the figures on cotton and overhead cost per pound were taken from the latest semi-annual cost of manufacturing statement. If one makes the reasonable assumption that cotton prices and overhead rates did not change much during most six month periods, then it is apparent that Lyman Mills, without having to take physical inventories, had useful estimates of total manufacturing cost at monthly intervals. Indeed, the monthly cost statements excelled Lyman's regular bookkeeping system, which resembled a manufacturing accounting system, to provide aggregate cost data as promptly and as reliably as that made available in a modern cost accounting system.

Lyman Mills did not stop, however, with the accumulation of aggregate cost data by mill and by type of input. At a very early date the company went one step further and produced periodic information on the unit cost of each cloth style which they manufactured. The raw data needed to estimate product costs appear in the company's records as early as 1875,²¹ although actual product cost calculations before 1886 are not found in the documents that now remain.²² The procedure which Lyman Mills used to estimate unit product costs was not described in accounting publications until about 1899 or 1900.²³ Basically, unit cost was based on the average weight of the yarn in each style of cloth that was manufactured. The weight of yarn that was manufactured was readily available in daily production records. The main

problem was to determine the cotton, labor, and overhead costs per pound of yarn. It was very easy to determine the cost of cotton, the most important element of cost, since it was accounted for on a cost per pound basis. It was more difficult to allocate labor and overhead costs among the various styles. Basically, the average labor and overhead cost per hank of yarn²⁴ was calculated every six months, and that average cost was multiplied by the number of hanks per pound in each style to get an estimate of the labor and overhead cost per pound. In this way, the company derived an estimate of total cost per pound for each style produced every six months. It was a simple matter to convert the cost per pound figures to a cost per yard basis.

These product cost statistics, calculated semi-annually at Lyman Mills at least as far back as 1886, are probably less accurate than those one might get from a modern textile mill's process cost accounting system; however, they gave a reasonable idea of relative cost differences between styles and of changes over time in unit costs. The mechanical accuracy of these calculations was checked by multiplying the estimated unit cost per pound figures by the total pounds of each style produced every six months to arrive at an estimate of the total cost of goods manufactured. The last figure was then compared with the total cost recorded in the plant ledger mill accounts. The difference was never very great, usually less than 3 per cent of total cost in the mill accounts.²⁵

That the company took great care to estimate product costs after the early 1880's is not surprising. In the 1880's, as I noted above, Lyman Mills was expanding its range of "fine" goods styles in order to counter growing competition from southern mills in the "coarse" goods market. The Treasurer's correspondence indicates that he frequently used the cost per yard statistics during the 1880's and 1890's when negotiating prices for styles that were

marketed by the company's selling agent in New York.²⁶ Furthermore, it is not unlikely that decisions to discontinue production of certain styles were based on these unit cost data. Such decisions are suggested by the frequency with which styles were changed and the narrow margin between unit cost and average selling price of certain styles of output. There is no doubt that the cost per yard figures became increasingly important for management decision making at Lyman Mills after the 1880's.

There are other features of Lyman Mills' cost system that would be interesting to examine, but to do so would not add much to the conclusions reached above. Among these features are the records for cotton transactions which showed a great deal of detail on every bale ordered, received, on hand and put into production. Equally impressive are the company's subsidiary payroll records in which labor costs were summarized by process. Production records were maintained, of course, that show in pounds and yards the flow of yarn and cloth through various production processes. The internal control features of these records, an aspect of the accounting system not discussed here, seem as elaborate as those in the records of a modern small-scale manufacturing firm. In fact, the company could have designed a modern process cost accounting system by modifying only slightly the records that they used after 1856.

Quite clearly, the cost system used by Lyman Mills during the late nineteenth century was far more elaborate and more useful to management than the mercantile trading account system which accounting historians attribute to industrial firms before the late 1880's or early 1890's. Although modern cost authorities would not sanction either Lyman Mills' practice of excluding unexpired labor and overhead costs from ending inventory or their failure to include plant depreciation in the overhead base, these minor technical matters

cannot obscure the remarkable efficiency of the Lyman cost system. The Lyman Mills manufacturing accounting system provided useful data on operating costs for the company as a whole and for each of the two main classes of output. Lyman's management used these cost data to assess current operating results and to evaluate potential savings from new machinery and new plant layout. On the other hand, after the 1870's the company had reasonably good product cost estimates that were used to evaluate pricing and output decisions.

Thus, for both total costing and product costing, Lyman Mills had an accounting system superior to anything described in contemporary accounting publications, at least to 1900. Further, it is clear that Lyman's system was designed largely to supply management with reliable cost data for decision making. We noted above that accounting historians, from their research in late nineteenth century accounting publications, have had little to say about the development of cost accounting as a management tool. In general, they assert that cost accounting grew from mercantile bookkeeping as a rational response to the Industrial Revolution. Thus, a common generalization is that cost accounting emerged first among large-scale firms in capital intensive industries, such as railroads and steel producers. Presumably such firms had a high degree of market control which meant that they needed reliable cost data, especially on overhead costs, to determine prices. The logic of that generalization is certainly sound and no doubt many firms did develop cost accounting systems for such reasons. In the case of Lyman Mills, however, we see the early development of a sophisticated cost system in a relatively less capital intensive firm that operated in a very competitive market. Although Lyman Mills had to act as a price taker, they could nevertheless vary output in line with cost expectations. It is not surprising, therefore, that they put a great deal of effort into product cost determination at an early

date. This suggests that individual companies had many varied reasons for developing cost systems in the late nineteenth century, and these reasons can be analyzed best by examining company records wherever possible.

Accounting historians have learned a great deal about the general evolution of cost accounting from a bookkeeping standpoint, but a great deal of research must be done in company records, such as those described above, in order to trace the development of industrial cost accounting as a management tool.

FOOTNOTES

¹The lack of research on management use of cost accounting has been noted in Henrietta M. Larson, Guide to Business History (Cambridge, Mass., 1948), 563 and 834; David Solomons, "The Historical Development of Costing," in D. Solomons, ed., Studies in Costing (London, 1952), 4; and A. C. Littleton, Evolution of Accounting to 1900 (New York, 1933), 350. A very complete bibliography of the extensive literature by accounting historians is in S. Paul Garner, Evolution of Cost Accounting to 1925 (University, Alabama, 1954), 392-404. The most comprehensive syntheses of the literature are available in the two books by Garner and Littleton. Two more recent works, both excellent, are Sidney Pollard, The Genesis of Modern Management (Cambridge, Mass., 1965), 209-249 and Neil McKendrick, "Josiah Wedgwood and Cost Accounting in the Industrial Revolution," The Economic History Review, Second Series, XXIII (April, 1970), 45-67.

²The description of manufacturing and cost accounting given here is a modified version of the format presented in Stanley B. Tunick and Emanuel Saxe, Fundamental Accounting (Englewood Cliffs, N.J., 1956), chs. 25 and 26. A more advanced discussion of the subject is in Lawrence L. Vance, Theory and Technique of Cost Accounting (New York, 1958).

³For an example, see A. C. Littleton, op. cit., 340-348.

⁴Ibid., 344. David Solomons, op. cit.

⁵A. C. Littleton, op. cit., 359 and 360.

⁶See especially the selections by Pollard and McKendrick cited above.

⁷In several of his published works, Alfred D. Chandler has noted the importance of cost accounting for large-scale industrial firms after 1870 and the need for more research in the area. See especially his recent book with Stephen Salsbury, Pierre S. du Pont and the Making of a Modern Corporation (New York, 1970), chs. II-III and V-VI and his Strategy and Structure (Cambridge, Mass., 1962), 174-185.

⁸These records, housed in Baker Library at the Harvard Graduate School of Business Administration, are described in Robert W. Lovett and Eleanor C. Bishop, List of Business Manuscripts in Baker Library (Boston, 1969), 38. In the following pages, these records are referred to as "Lyman Collection," with the Baker Library manuscript index reference given.

⁹Lyman Collection, A-2 (inside front cover).

¹⁰Lyman Collection, MAE (data on looms in operation by mill at six month intervals).

- 11 Lyman Collection, CA (general ledger) and CB (plant ledger).
- 12 Lyman Collection, LC and LT.
- 13 Depreciation of manufacturing plant and equipment was not accounted for in the modern sense. Expenditures for plant, equipment and major renovations were generally charged to profit and loss in the general ledger in the year they were incurred. Such charges were not entered in the plant ledger and therefore did not affect the data in the company's cost of manufacturing statements (see below). Ordinary repair costs, however, were included in the overhead expense total.
- 14 Lyman Collection, AM (overhead distribution sheets in the semi-annual accounts).
- 15 Subsequent adjustments were recorded in the cotton accounts when actual cost and shipping charges differed from the original estimates.
- 16 In some years, particularly after 1887, the balances in the general ledger cotton accounts were written down to market when market values fell below original cost. These write-downs were charged against profits in the year affected, but were not recorded in the plant ledger.
- 17 Lyman Collection, AM (Treasurer's reports).
- 18 Lyman Collection, MAE.
- 19 Lyman Collection, PA and PB. For example, see letters from the Treasurer to the Agent dated 12/8/84, 2/4/85, 2/19/85, 5/23/85, 11/13/85 and 4/7/86 (PB-14 and 15).
- 20 Lyman Collection, MAE.
- 21 Lyman Collection, MAH-1.
- 22 Lyman Collection, MAF.
- 23 William G. Nichols, Methods of Cost Finding in Cotton Mills (Waltham, Mass., 1899), 8-18. James G. Hill, "Various Systems of Computing the Costs of Manufacture," Transactions of the New England Cotton Manufacturers' Association, 67 (October 5-6, 1899), 132-137.
- 24 One hank equals 840 yards of yarn.

²⁵Lyman Collection, MAF.

²⁶Lyman Collection, PB. Examples are letters from the Treasurer to the Agent dated 2/4/85, 5/16/85, 9/30/86, 7/15/87, and 9/15/87.