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Gloria Vollmers

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Gloria Vollmers
UNIVERSITY OF MAINE

ACCOUNTING FOR IDLE CAPACITY: ITS PLACE IN THE HISTORICAL COST LITERATURE AND CONJECTURE ABOUT ITS DISAPPEARANCE

Abstract: How best to provide management with useful information about the underutilization of factory and machinery are old cost accounting questions. The literature from the turn of the century up through the 1950s reveals that the topic interested many. This paper resurrects those historical discussions. The objective is twofold, to demonstrate the sophistication and innovation of early writers emphasizing why they thought the topic important, and, to explore some theories about why this interest dissipated within the accounting literature. The possibilities include the effect of the great depression, wartime regulations, the withdrawal of the industrial engineer from costing and the growing importance of income measurement. This research ends in the 1960s, by which time idle capacity as an independent topic has largely disappeared.

Accounting for and providing management with information about idle time and idle capacity[1] was a subject that occupied cost accountants primarily in the first half of this century. Garner's (1976) review of the literature from 1900 to 1925 showed that the topic appeared frequently and regularly. The economist, J.M. Clark, thought understanding and controlling capacity to be of such importance that he made it the central theme of his landmark 1923 book, *The Economics of Overhead Costs*. While some of Clark's topics, such as his exploration of differential analysis, remains in modern texts, his particular interest in the isolation and interpretation of idle capacity disappeared. Many authors of cost textbooks before 1950 gave substantial space to the problem of idle capacity, but its coverage declined and it has only been in recent years that capacity issues have reappeared in the cost literature.

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[1]The subject of idle time includes the idle time of labor, the idle time of specific machines and the idle time of the factory, more commonly called idle capacity. In the literature and in this paper, the terms are used interchangeably.

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Of the idle time of labor, of machinery and of the factory, the latter two dominate the literature. Writers in the cost literature from 1900 to 1960 seldom address the topic of idle labor. Garner's (1976) work shows only the technical, that is, the bookkeeping, aspect of labor accounting. There are no later articles illustrating how accounting measurements might be used to provide information for management control purposes (examples of the technical type include: Brown 1927, Peden 1934, Totten 1941).[2] Managers undoubtedly observed and controlled labor outside of or tangentially to the accounting system. The consistency with which the literature treats labor as a pure variable cost[3] suggests that it was either easily managed or was subject to other controls.[4] For these reasons, labor issues will not be covered here.

This paper resurrects historical discussions of idle capacity. The objective is twofold, first to demonstrate the sophistication and innovation of early writers emphasizing why they thought the topic important, and second to explore some theories about why this interest dissipated within the accounting literature. This research ends in the 1960s, by which time idle capacity as an independent topic has largely disappeared.

This paper is divided into five sections. The first describes broadly why idle capacity was important to early cost accountants and, briefly, why it lost its importance. The second reviews a variety of writings on the subject from 1900 through 1960. The third presents evidence of the disappearance of the subject from the literature. The fourth examines reasons why the subject disappeared. The fifth is the conclusion.

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[2]Labor variances are found throughout the literature. However, these presentations are not accompanied by lengthy discussions about the importance of the issue beyond the technical aspects of accounting.

[3]A few writers suggest situations where some labor costs might be recorded as fixed rather than variable (Alden 1924). One instance would be when highly skilled workers are retained despite lack of work in order to preserve their skills for the firm. The other possibility is to record as fixed, the wages of the minimum personnel needed to operate.

[4]The few references to idle labor in the cost literature treat it casually by remarking that "labor can be discharged or put on fewer hours when output declines" (Dohr, Inghram and Love 1935). Fiske (1931, 355) said that "losses arising from idle labor are less significant than those arising from idle plant since in most cases labor costs are at least partially controllable through layoff."

INTRODUCTION

The cost literature contains many references to and articles about factory and machine capacity through the 1950s. While overhead in general was always the literature's dominant topic, the particular interest in idle capacity was a consequence of substantial investments in plant and machinery and the influence of the industrial engineer. The early decades of the century were ones in which the engineer and the cost accountant focused on the productive or operational efficiency of the plant.

The beginning of the century witnessed an explosion of machinery in manufacturing and a fascination on the part of society as a whole with science, efficiency and standardization (Chase, 1929a & b; Boorstin, 1973). Accompanying the heavy capital investments in plant and machinery was a rise in mass production techniques best symbolized by Henry Ford's automotive operations (Garner, 1976).[5]

Mass production was both a result of the capabilities of machines and a reaction to them. "The large investment in the machinery and equipment of an industrial plant necessitates getting the utmost use out of this equipment. Proper planning . . . and regulation . . . constitute one of the greatest problems in industrial management" (Jordan and Harris, 1920, p. 402). "After all, the measurement of a business is not its capitalization or the magnitude of its physical equipment, but the net return on the capital employed" (Peden, 1924, p. 121). Large capital investments seemed to mandate mass production and a drive to make that production efficient.

To meet the needs of this newly developing industrial society, a new kind of engineer evolved. Mechanical engineers began to discuss efficiency at the end of the 19th century — how to measure it and how to increase it. Interested in the efficiency of the production process and the maximization of the output of both people and machines, these engineers were the genesis of what was later called the Scientific Management movement.[6]

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[5]See particularly extensive quotes by Alfred Sloan regarding the necessity of mass production at Ford Motor and Hyatt Roller Bearing Company in Garner (1976, 210-212)

[6]The term, Scientific Management, was coined by Louis Brandeis who popularized it when he testified in 1910 against the request for rate increases by the eastern railroads in front of the Interstate Commerce Commission. He claimed (having read Frederick Taylor's works) that the railroads were poorly managed and that if they were more scientifically managed they would profit more than by increasing their rates (Boorstin 1974).

Their descendants are today's industrial engineers. Their interest in efficient production processes linked up early with cost accounting. It is from their work that time studies, standardization and wage incentive plans derived—all methods employed to increase efficiency. Many of them contributed heavily to the cost literature.

The depressions of 1920-1921 and the 1930s brought into stark relief the devastation of deep undercapacity usage. Factory and machinery were large investments that could not be laid off or ignored. Under these conditions, thoughtful accountants and engineers warned that failure to understand and communicate the implications of undercapacity usage would lead to dysfunctional decisions.

> In a period of declining output the manufacturer is likely to conclude that selling prices must be increased in order to cover the increased costs whereas an increase in selling prices leads only to further decline in demand and in output (Dohr et al., 422, p. 1935).

In later decades, although references to capacity and efficiency issues appear periodically in the literature, there was a clear decline. One reason for this was a shift in emphasis from the production function to the sales function. It became more important to anticipate sales and plan production to meet sales requirements than it was to measure whether machinery was producing as efficiently as possible. Identifying the reasons for this shift is one of the purposes of this work. Major upheavals in the economy, the great depression and World War II, certainly contributed. Another appears to have been the emergence of income measurement, dominated by financial accounting's matching principle. The matching principle helped to move the definition of efficiency away from the capacity of factory and machine to how closely production could be tied to sales. The cost accounting system was no longer used to identify the underutilization of facilities.

ACCOUNTING FOR IDLE TIME

Operational Efficiency

Early in the century, Alexander H. Church (1901), an engineer, published a series of articles describing a method of accounting for factory overhead costs. His influential but controversial ideas included isolating the cost of idle machinery.

Although others also tackled the idle time problem, his work is particularly memorable. His contemporaries cited, argued about and praised his prolific writings for three decades and his work is still remembered.[7]

Critical of the common practice of applying overhead using a single, factory-wide rate, he insisted that multiple rates were needed in order to generate useful information. He proposed that the factory be divided into 'tiny shops'—small work areas or work benches—departments usually composed of a single machine operated by one man. Overhead costs were to be carefully apportioned among these tiny shops and then applied to products using a machine hour rate calculated for each individual shop.

In the denominator of the application rate was the normal number of hours the machine should be used. 'Normal' hours were those during which the machine could operate less an allowance for usual downtime such as repairs. If the machine were idle, the overhead for those hours would be entered into an idle time account. Church (1901) said that the sum of the dollars spent to maintain capacity was analogous to water dripping—dripping from as many faucets as there were tiny shops. Either the water dripped into a job or it dripped into a pool of waste. Fixed costs, already sunk into the factory, could only be recovered through useful production. Idle time, therefore, was money lost and its segregation would show management just how expensive operational inefficiency was.

Church was not alone in his concerns. Gantt (1917, 370), another engineer, wrote that "the expense of maintaining machinery in idleness is far greater than most people realize . . . and all who wish to operate efficiently will begin at once to see how it may be minimized." Harrison (1919, 443), a cost accountant, in a critique of contemporary cost accounting wrote:

> Cost systems do not show the cost of non-production but ingeniously saddle the machine which works with the cost of the machine which is idle . . . (T)he merging of the cost of idleness with the cost of production absolutely kills the value of cost statements considered as indices of operating efficiency.

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[7]Richard Vangermeersch's work on Alexander Church, engineer and accountant, is important to those interested in the development of cost accounting in the first third of this century—see bibliography.

He predicted that engineers would take over cost accounting unless cost accountants improved their information producing capabilities. Engineers and accountants in the literature agreed that managing facilities in order to maximize the productive output of machines was of prime importance. The question was how the cost system could highlight areas of inefficiency. Although the answer did not always come exclusively from formal accounting records, the primary source of information was over- or underapplied overhead as measured in each department. However, this measured efficiency only if the denominator volume of the overhead rate calculation was carefully calculated.

Normal Capacity

To separate productive hours from idle hours most authors, including Church (1901) and Jordan and Harris (1920), used 'normal capacity.'[8] The term itself, 'normal capacity,' was not applied universally so a reader must read texts closely to discover how each author defined the denominator volume. Nevertheless, most described a production-linked denominator which was commonly called 'normal capacity.' Normal capacity was the number of hours machinery should be operating (usually reduced by an allowance for average downtime). It was to remain stable over a period of years so that costs could be meaningfully compared over time. (Normal could also be applied to labor hours if machine rates were not used.)

The 1921 NACA-Yearbook contains the papers and discussions of a conference devoted largely to the subject of overhead distribution under abnormal conditions (the 1920-21 depression). The participants discussed terminology at some length.

> What is a normal overhead rate? Is a rate which during a period of normal production and normal expense will absorb all the overhead expense of that period...The most difficult thing to determine will be the normal volume of production. Normal production does not mean possible production (Williams, 1921, p. 203).

[8]The literature implies that most companies did want to use a predetermined overhead rate as opposed to waiting until the end of the year to gather actual overhead costs and apply them at that point. No doubt some companies did wait for actual costs but the literature reflects a clear preference for anticipated costs.

> One essential element has been neglected in developing this normal rate . . . In predetermining a burden or expense rate to be applied to costs, a sufficient period should be reviewed to include a cycle of both good and bad business years (Merrifield, 1921, p. 212)

Using normal capacity to allocate overhead would produce idle time losses if machinery were underutilized. It could also generate an over-capacity gain but such an occurrence was rarely considered in the literature. Clapp (1921, p. 223) said that a cost system that did not measure idle time failed to provide critical information about the efficiency of production. Normal rates were needed to "to supply information to the executive department to enable it to gauge the operations of the factory." The participants finally voted on a definition.

> 'Normal capacity basis' is the total possible time (that means any kind of work, machine or other), less reasonable allowance for break-downs, repairs, inefficiency, reasonable lack of operators, and all other regular normal delays outside of lack of orders to run on (NACA-Yearbook, 1921, p. 241).

The definition was based on productive output.[9] Anticipated sales volume did not enter into overhead rate because managing the equipment in order to coax as much production out of it as possible had nothing to do with the availability of or lack of sales. Most important, since overhead costs were applied at the departmental level, productive inefficiencies could be identified at a micro level.

The definition of what constituted a 'department' in the cost literature was unique. Briefly, a department was a machine or group of similar machines that produced a single product (or similar group of products) under the supervision of a single manager (Lawrence, 1925, p. 24-25; Dohr, Inghram and Love, 1935, p. 66; Blocker, 1950, p. 22). The numerator of the overhead rate was calculated for each department. Direct overhead costs (e.g. departmental depreciation) were included as well as joint overhead costs that had been allocated using a base that had, if possible, a causal relationship to the costs (e.g. janitorial costs based on square footage). Dividing this total by normal

[9]Of the 11 people contributing articles or entering into the discussion, none were academics—all were employed by companies as either accountants or engineers.

capacity for the individual department produced a departmental overhead rate. This permitted managers to observe the proportional demands on elements of overhead of different departments and product lines. In none of the texts or articles used for this paper did any author recommend factory-wide overhead application rates.

> With unearned burden (idle time) eliminated, the unit cost of lots produced may be fairly compared from one period to another, and made the basis for a satisfactory measure of the operating efficiency of the department. These costs may also be compared with the standards of efficiency which have been established, thereby giving a true conception of the value of the results obtained, regardless of any variation in the volume of production. The actual expenses are compared with the budget, and the actual production or operating time compared with the standard, thus giving us two very effective checks on the efficiency of each department (Crockett, 1921, p. 218-219).

It is very significant that the definition of normal capacity excluded sales. This productive or operational efficiency view of costing emphasized the manufacturing function over the sales or marketing function of a business. It was not until the 1930s that one finds denominator volumes based on budgeted sales in the cost literature. It was the change in the denominator volume that signaled a movement away from measurement of productive efficiency.

Idle Time And Product Cost

Productive efficiency was not the only reason for tracking idle time—determining product costs was another. Church (1901) said that since the factory existed to produce goods, all costs were product costs. The idle time charges generated by his method were reallocated over production by means of a supplementary rate. This would allow management to see, on a full cost basis, how much each good actually cost (Vangermeersch, 1986; Garner, 1976). This aspect of his method was controversial because it resulted in dramatic changes in per unit cost under volatile business conditions. Few viewed an idle time loss as a product cost. Church (1930) later abandoned the supplementary rate and instead adopted, as did the majority of other authors, the practice of expensing the idle time account as a line item to profit and loss.

Jordan and Harris (1920) joined many writers concerned by the effect on per unit cost of changes in factory capacity and in the volume of production.[10] Production volume has a large effect on per unit total cost if the fixed overhead rate is calculated based on different yearly volume estimates or if the idle time of a particular year is redistributed back over that year's production. In periods of high production, costs appear to decrease and in periods of low production, costs appear to increase.

Concerned that these variations could be misunderstood and lead to dysfunctional managerial choices, Jordan and Harris (1920) and Clapp (1921) wanted to distinguish between idleness due to manageable problems and those due to economic conditions. The use of a normal capacity denominator was the means to this end. It stabilized the fixed overhead portion of product cost over a period of years so that the unmanageable variations in the economy were smoothed out and allowed managers to make meaningful comparisons of costs from period to period.

According to Williams (1921, 210), the advantages of using a normal rate included the ease with which management could assign selling prices, calculate total cost per unit and avoid burdening monthly inventories with excessive overhead. He doubted that managers could wisely interpret data that had not been calculated using a normal rate:

> The advantages of using a constant, normal, or average overhead are largely psychological. (It) ... does not make costs lower, sell goods more quickly, or miraculously start factories working again. Such a policy, however, does permit the management to go ahead and figure their list prices and future profits without the upsetting factor of this excessively high overhead staring them in the face in such a way as to disturb their equilibrium and cause their reasoning faculties to become warped, because of the apparently panicky or impossible conditions confronting them (Williams, 1921, p. 208).

Dohr et al. (1935) agreed with Williams (1921). Unit costs inflated by idle time losses in times of low volume production encouraged managers to raise prices—the worst possible policy in periods of depression. Dohr et al. (1935) preferred to expense underabsorbed overhead charges as idle capacity losses and

[10]See Garner (1976) for a comprehensive discussion of early approaches to idle time problems, from the end of the 19th century until 1925.

overabsorbed charges as gains on intensive use. They viewed as an abuse the practice of taking under- or overabsorbed overhead amounts to a reserve account to smooth out profits.

Idle Time and Pricing

Although a cornerstone of classical economic theory is that prices are determined by supply and demand, there are numerous references in the cost literature to the practice of setting prices based on cost or, at a minimum, using cost information as an input into the pricing decision (Williams, 1921; Clark, 1923; Lawrence, 1945; Clark, 1965 (1947 reprint); Devine, 1950; Rushton, 1954). A 1963 NAA Research Report (#39) reported that firms relied heavily on product costs for pricing purposes.[11] Many claimed that managers often based prices on the total unit cost of a product (Jordan and Harris, 1920; Randleman, 1956).

> Just recently I learned of a large producer of malleable castings who quoted on an order for castings and who, when told that his price was too high, explained that he could make them at a lower price under normal conditions, but that at present his foundry was operating to only 30% of capacity and therefore he must obtain a higher price in order to avoid loss. He went so far as to refuse the order at a price which he admitted would be satisfactory if he were operating at normal capacity (Williams, 1921, p. 201).
>
> (Cost accounting) ... offers great possibilities in the way of developing a standard of sound or conservative practice in fixing prices, which will act as a check on cutthroat competition ... And of course the critical point is, after all, what the management does with the figures after it gets them; what use it makes of them in the actual fixing of prices (Clark, 1923, p. 14).
>
> By using normal volume ... we enable industry to establish and maintain a sound price structure. This will tend to eliminate cutthroat and ignorant competition ... Normal burden rates should not include any expense of inefficient operation of any nature, including equipment not required for the business. Otherwise, such inefficiency may gradually force quotations beyond market possibilities (Downie, 1944, p. 7-8).

[11]There is a substantial bibliography of articles on cost accounting and its relationship to pricing decisions in this NAA study and in #24, "Product Costs for Pricing Purposes" (August 1953).

The value of a cost structure based on a measure of normal capacity included keeping management attuned to a long-term vision. This vision would encourage a reasonable approach to product pricing. Prices over the long run had to cover all costs, but there was general agreement that allowing prices to follow short-term cost fluctuations was not only dangerous for the individual business but for whole industries as well.

Accounting For Idle Time—Two Presentations

Alden (1924, p. 115) illustrated how idle time was measured and how those measurements were used in his company. Normal capacity was approximated at 80% of the possible production of individual, but related, machine groups. Each month productive hours were gathered from job tickets. Some slack time was added to cover repairs and waiting for tools and supplies. The percentage of productive hours to normal hours was called the measure of degree of operation. The difference between the degree of operation and normal was the percentage of idleness. The percentage of idleness was then applied to each overhead item for each machine group and the sum of all of these calculations was idle expense. For service departments, the degree of idleness was figured on the basis of the factory as a whole. The expenses of the service departments were allocated to productive departments only after the idleness portion had been subtracted and expensed.

Alden (1924, p. 120) explained that this procedure isolated idle time losses at the departmental level. Foremen could see where inefficiencies existed, how much they cost and received feedback on the measures taken in the past to increase efficiency. Additionally, because idle time charges were not included, inventory values were conservatively stated. This simplified the preparation of federal tax returns. The tax code required that inventories be stated in accordance with the best accounting practice and Alden (1924) and Cornell (1930) agreed that conservative valuations were representative of the best practice. Additionally, creditors, who relied on inventory figures for their lending decisions, benefitted from these lower valuations.

Fiske's (1931) analysis of idle time was comprehensive and detailed. He divided its causes into three separate areas: productive, administrative and economic. Productive causes included breakdowns and powerdowns. Administrative causes included building a factory larger than needed and retaining highly skilled workers when not needed in order not to lose them.

Economic causes included seasonal businesses, cyclical business cycles and broad changes in demand that created conditions of over- or under-capacity. He believed that management made poor decisions when they were not aware of the varied causes of idle time losses which were usually aggregated into a single number.

> The ultimate purpose of all accounting is to provide management with the necessary facts upon which action may be taken to increase profits by decreasing expense, and to provide management with the basis for evaluating the results produced by the various department heads . . . If management were interested in total costs alone, there would be no need of keeping records of cost of idle time since it could be included by neglect, but if the management is interested in information as a basis for control, it is necessary to accumulate information regarding the cost of idle time (Fiske 1931, p. 360-1).

Fiske (1931) suggested that idle time losses caused by normal seasonal idleness be charged to the product while those attributable to excess capacity arising from equipment purchased for future use be currently expensed. As for other causes of idle time, he was not concerned with technical accounting per se, but with using accounting to illuminate the sources and causes of idleness. He recommended keeping statistical records separate from the ledger to track the various causes of idle time losses and to assess responsibility where possible.

Idle Time and Supplementary Records

Brummet (1957, p. 11) criticized the early advocates of tracking idle time from 1890-1930 for believing that one cost measurement would suffice for all purposes. However, there is evidence that at least some writers during that period recognized that supplementary information was needed.

Jordan and Harris (1920), in their cost textbook, reported that managers failed to get the most out of their equipment because information about problems was not timely.[12] They suggested that multicolored cards representing the status of each piece of equipment be placed on a dispatch board to flag those

[12]An entire chapter of their book is devoted to the problem of idle machinery.

responsible for keeping the machines running.[13] Feedback was important so cumulative reports should be kept for each machine showing productive and nonproductive hours and the reasons why the machines had been idle. "This report reflects every week the running conditions of the equipment and shows up both successes and failures of the effort to eliminate idle time of equipment" (417).

Sanders (1923, p. 17) said that the cost department should produce a variety of useful data. Some " . . . control records need to be expressed in terms of money, and incorporated in the accounting system . . . (other needs) . . . may be adequately served by keeping only quantitative statistics, such as quantity of materials used, amount of time taken on operations, quantity of goods produced and the like."

Randleman (1956) also recognized the necessity of supplementary information. He discussed the differential information arising from the use of alternate definitions of normal capacity. One, average capacity, was based on expected future sales over a period of years. The other, practical capacity, was the volume at which the plant was equipped to operate or the maximum capacity attainable (the later has often been called 'theoretical capacity').[14] Each had advantages and disadvantages. Average capacity produced higher unit costs and hid idle capacity losses but was preferred for long-term pricing decisions. Practical capacity highlighted idle capacity, providing information for control purposes, but was misleading for pricing decisions.

Randleman (1956) said that no single method of assigning costs to inventory could fulfil all needs—additional statistical records were necessary. These records would include: estimates of average commercial demand, factory capacity that will remain unused in meeting average commercial demand, expected long-term product costs, a long-range predetermined price setting policy, schedules of production levels and employment levels. All of these cost records would provide realistic short-term product costs, reveal the inefficient use of facilities through the analysis of unabsorbed burden, and state inventories and profits at conservative levels. Vance's (1958) textbook also recom-

[13]The primary causes of idleness were: no operator, no material, no orders, machine breakdown or under repair, no power, waiting for set-up, waiting for tools and waiting for instructions (Jordan and Harris 1920, 406).

[14]Note that when Randleman (1956) calls the 'volume at which the plant was equipped to operate,' 'practical capacity,' the use of that term is similar to the earlier usage of the term 'normal capacity.'

mended that statistical records be kept to illuminate idle machinery.

Churchill (1958) echoed Randleman (1956). Management needed a variety of information to meet different decision needs. He did not recommend any single method of accounting because the choice of denominator volume and whether idle capacity costs were charged to inventory or to the period was not as important as understanding and analyzing the information embodied in the costs. "Data in which too much has been merged will be meaningless . . . the proper determination of the costs attributable to idle capacity is important" (Churchill, 1958, p. 87).

From the beginning of the century, until approximately 1960, there was a strong interest in operational efficiency, and in how cost accounting, by highlighting facilities usage, could contribute to these efficiencies. Many recognized that accounting methods could lead to dysfunctional decisions. At the same time, some practitioners and academics warned that the use of any single measure was insufficient for management needs.

IDLE CAPACITY MEASUREMENT BEGINS TO DISSIPATE

New ideas in cost and financial accounting were developing in parallel with these older notions of operational efficiency and were soon to come to prominence. Idle capacity measurement, a function of engineering or productive efficiency, began to disappear when financial accounting began to measure sales or marketing efficiency. This is not meant to be an absolute statement. Interest in capacity never completely disappeared and much of the modern cost literature, including *The Goal* (Goldratt and Cox, 1984) and *The Profit Potential* (McNair, 1994) explore capacity issues in detail. However, the 1963 NAA Research Study #39 showed that while capacity continued to interest the NAA, few of the surveyed firms at that time tracked idle capacity in their books. Formal measurement of idle capacity had largely disappeared. In its place were measures of sales or selling capacity and income measurement.

Earlier, a NACA research study (*Bulletin*, 4/1/38, p. 925) surveyed the overhead practices of its members. The definition of 'normal' had already changed since the 1921 vote. 'Normal capacity' in this 1938 study usually meant (bearing in mind that the study found much variety in terminology) "the expected utilization of the plant over a period of years in the future, taking

into consideration both expected sales for the period and the capacity available." Of 194 firms that reported using normal capacity, only 39 based it solely on the ability to produce while 138 considered both the ability to produce and sell.

This survey marks a major break in the presentation of capacity themes in the literature. There had been movement away from an engineering-oriented view of 'normal' toward a marketing or sales-orientation. The implications of this shift are profound. If budgeted production based on expected sales volume is used in the denominator of the overhead rate, then the volume variance does not measure operational efficiency. It measures whether production did or did not exceed a budget and not the extent to which machines and factory were productive.

Of the 224 firms surveyed, 69 isolated fixed charges on idle plant and equipment from overhead and 55 of those charged that amount to profit and loss. That is to say, fixed charges on *completely* idle assets were not added into the overhead rate calculation. It was implied that *partial* idleness was not considered. Of the 90 companies that did accumulate idle charges arising from underused capacity, only 26 of them expensed them as a line item—the remainder charged them back to cost of goods sold—precisely the choice that earlier writers had condemned as misleading.

DeCoster (1966) recognized this change in orientation. He argued that contemporary accounting literature was confused about idle capacity losses saying that most authors of articles and texts mistook the variance generated by the difference between actual and expected sales as a measurement of productive efficiency. That is, while the terminology of productive efficiency, that of idle capacity, had survived, the computed variance was not measuring it.

Evidence supporting DeCoster's (1966) observation can be found in two articles by Horngren (1967, 1969). He analyzed the capacity variance that was then commonly computed. The variance, expected idle capacity, was calculated as the difference between possible production and estimated sales. Other variances included in the articles included: budgeted sales less actual sales, budgeted sales less sales orders received and sales orders received less actual sales. The older measurement of idle capacity—the difference between normal and actual production—never appeared. In fact, his definition of 'normal' was "the rate of activity needed to meet average sales demand over a period long enough to encompass seasonal and cyclical fluctua-

tions" (255). Horngren (1967, p. 260) maintained that information about idle facilities was needed "at the master budget planning stage, not the evaluation of performance stage." He ignored the informational value of interim capacity changes. None of his variances provided information about capacity opportunities. Analysis of capacity, an operational measure, bowed to sales measures.

The final evidence that change occurred lies in modern cost textbooks. The majority of these texts use annual budgeted production generated from annual expected sales in the denominator of the overhead rate calculation (Usry and Hammer, 1991; Barfield, Raiborn and Kinney, 1994). "Under a normal cost system ... The rate is developed by predicting total overhead costs for the coming year and dividing them by the predicted total activity for the coming year" (Morse and Roth, 1986, p. 69) The same definition appears in Moriarty and Allen (1991, p. 581) and in Horngren, Foster and Datar (1994, p. 537). While many of these books touch on alternative capacity measures and spend a page or two on capacity problems in general, in no way could the discussions be viewed as comprehensive. This contrasts, for example, with 20 pages of text in Dohr, Inghram and Love (1935) and a full chapter on the subject in Jordan and Harris (1920). The overhead rate used throughout each modern text is based on a yearly budgeted number and linked to income measurement. Because the rate changes with different annual budget expectations, product costs cannot be compared from year to year. For the same reason, no variance provides information on capacity usage.

It is impossible to pinpoint this change in focus since it was clearly evolutionary but this work attempts to trace some of the paths leaving to others the opportunity to research them further. At this point then, we return to the past to search for sources of these changes and to suggest reasons for them.

THE SHIFT TO SALES EFFICIENCY— A TENTATIVE EXPLORATION

The Great Depression

What factors may account for the shift from operational to sales efficiency? During the depression of the 1930s, companies operated well under capacity for many years. Tracking idle capacity may have become superfluous. It was far more important to search for sales opportunities.

Fligstein (1990) noted this transformation although his research interest was in methods of corporate control, not accounting. He distinguished between the manufacturing and the sales and marketing conceptions of control exercised by large firms. The manufacturing conception (operational efficiency) was one corporate response to competition.

> (M)anagers embraced tactics to promote price stability. (They) viewed stable pricing as attainable through attention to the production process. This caused them to focus on what they could control as a counterthreat: the flow of goods through the production process (117).

In contrast, managers at other firms began early in the 1920s to compete by searching for new markets, by differentiating their products, by advertising and establishing brand names rather than by controlling production and prices. His thesis was that the firms that embraced the manufacturing conception did poorly, as a whole, during the depression while those that had shifted to a sales and marketing conception survived. While Fligstein (1990) looked primarily at competitive forces and the drive to eliminate or minimize competition, his ideas appear to be reflected in this cost literature. Accounting for efficiency might disappear if economic conditions made productive efficiency irrelevant. That is, if products cannot be sold, there is little purpose in measuring whether machinery had been utilized to its fullest capabilities.

A related factor that deserves extended study was the influence of trade associations. Under New Deal regulations, a trade associations was allowed to gather costing information from firms in its industry and establish industry-wide minimum product costs. These minimums became floors below which firms in that industry could not reduce prices. The purpose was to eliminate cutthroat competition and thereby minimize bankruptcies. Although not particularly successful, there may have been long-term effects on cost structure (Galambos, 1966). Given this legal authority, there was an incentive to set product costs high enough to include idle capacity losses in order to ensure profit.[15] Also, if costs were set industry-wide, the incentive to continue to measure costs carefully was removed.

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[15]One can also imagine the incentive going the other direction. If the trade associations were dominated by the larger firms in an industry, they might want to set minimum costs low so that they could continue to charge low prices and force competitors out of business.

World War II and Government Regulation

It is highly conjectural to draw conclusions about the long-term effects of World War II regulations on cost accounting. However, it would not be appropriate to ignore possible effects for lack of solid evidence for there may well be links to the capacity issue. For the larger firm (and it is from relatively large firms that most of the contributions to the cost literature arise), the acquisition of government contracts meant the end of undercapacity for a sustained period of time. The government wanted output quickly no matter the cost.

Most government contracts were on a cost plus a fixed fee basis. Nonreimbursable costs were spelled out. One of these was "expenses, maintenance, and depreciation of excess facilities vacated or abandoned, or not adaptable for future use in performing contract or subcontracts (including idle land and building, idle parts of a building and excess machinery and equipment)" (Miller, 1942, p. 98). It was not necessary to track and exclude the idle capacity costs of active facilities. Reimbursement was based on the contract, not the product, so the cost of individual products became irrelevant. With cost recovery and profit guaranteed, there was little or no incentive to be cost efficient. The issue is one of institutional memory. Did firms that operated with war contracts for many years return to measuring idle capacity after the war or was this measurement forgotten?

Income Measurement—Direct Costing

Direct costing was first introduced in the 1930s. From two articles in the *NACA-Bulletin* in the 1930s to over 40 in the 1950s, it became a major topic in the accounting literature. Direct costing treats all fixed overhead costs as period expenses, not as costs of inventory. The logic of marginal revenue or contribution margin analysis (unit sales price less unit direct cost) impressed many. Today it is covered in virtually all cost and managerial textbooks as a decision tool, but, at that time, many wanted to use it for inventory valuation as well.

The 1953 NAA Research Series #23 on direct costing discovered only 18 companies using this method in their financial records and both the Internal Revenue Service and professional accounting bodies were opposed to it on theoretical grounds. The 1957 revision of the 1948 "Accounting Concepts and Standards Underlying Corporate Financial Statements" by the American Accounting Association said that omitting any ele-

ment of manufacturing cost from a product was unacceptable (539). Mssrs Hill and Vatter, in that publication, dissented from the majority view saying that direct costing was acceptable and "will, in many cases, yield results more useful to investors as well as to management" (545). For the purposes of this study, the important point is that while the information arising from a direct cost system is useful, it does not generate any data on idle capacity. Idle capacity was not an issue in that literature and that literature was pervasive for a long time. While direct costing was being discussed, productive efficiency was not.

Income Measurement—the Matching Principle

Perhaps the most important trend was the increasing interest in the calculation of financial accounting income for reporting purposes. Prior to approximately 1938-1940, the balance sheet was not only the predominant published financial statement, it was often the only financial statement. The components of income, such as 'Sales' and 'Cost of Sales,' had long been considered proprietary.[16] Rather than an income statement there might have been a single line, called 'earnings,' or, perhaps 'earnings before depreciation,' 'depreciation' and 'net earnings.' Often there was no reference to income at all.

The Securities and Exchange Commission began to insist on sales and cost of sales disclosures and, despite the reservations of the business community and the accounting profession, income measurement quickly commanded attention. Theories of income measurement took on increased importance. Soon, one theory came to dominance in the financial community and it governed accounting for cost of goods sold and the valuation of ending inventory. It was the matching principle.

Paton and Littleton's classic monograph, *An Introduction of Corporate Accounting Standards* (1940), made the matching principle, which linked economic benefits with economic sacri-

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[16]A 1935 JOA editorial shows the profession's antipathy to disclosure. The following is in reference to new SEC requirements.

> Here it is provided that the profit and loss statement shall disclose the amount of gross sales, cost of sales and gross profits...If we were to have a full disclosure of every item of the accounts of a corporation engaged in competitive endeavor there soon would be no competition...(They object to the disclosure of confidential information because) it would be detrimental to the interest of investors and therefore contrary to the purpose of the law; and the information itself might be misleading (162-163).

fices, preeminent. Sales were to be matched with the costs incurred to produce them. In order to match production with sales, the denominator volume of the overhead rate had to be based on sales. This matching process precluded any measurement of idle capacity. Horngren's (1967, 1969) articles cited earlier are excellent examples of financial accounting's adoption of the matching principle.

Ferrara (1960, 1961a&b) took the matching principle to the extreme. He argued that there was no such thing as an idle capacity loss for income measurement purposes. He proposed a unit of production method for allocating fixed costs, one that could not generate an idle capacity variance. He focused on financial income measurement—not on the operational needs of the firm. Ferrara wanted to match economic benefits (sales) with economic sacrifices (production costs) in order to produce the most theoretically correct measurement of income.

Weinwurm (1961) responded heatedly to Ferrara (1961b). He argued that accounting had a duty to provide information, information that included data on capacity usage. Allowing theories of income measurement to dominate risked damaging company operations. Despite Weinwurm's arguments, income measurement played an increasingly large role in financial accounting and had a substantial influence on cost accounting.

This focus on income measurement had consequences. If idle capacity were not measured, it may well have been ignored. Indeed, there is virtually no literature on idle capacity after this until decades later. Just as Brummet (1957) accused early writers of ignoring different costs for different purposes, so too can those of the 1960s be accused—they were interested in income measurement to the exclusion of other accounting purposes. While supplementary records outside of the formal accounting records could provide information on capacity usage, the silence of the literature suggests that the topic was no longer of interest and that firms were not measuring it.

The Disappearance of the Engineer

The final component of the diminishing interest in operational efficiency may have been the gradual withdrawal of the industrial engineer from cost accounting venues. From 1900 - 1930, engineers maintained a presence in cost accounting. There was a substantial amount of contact among engineers and cost accountants interested in disseminating cost information

through conferences and articles. Many cost textbooks were co-authored with engineers and engineers contributed regularly to the *NACA-Bulletin* and other publications of the National Association of Cost Accountants.

The engineering contribution to the *NACA-Bulletin* declined from 20% in the 1920s to 13% in the 1930s and 7% in the 1940s.[17] Vangermeersch (1984) presented evidence of the decline of engineers in costing without offering any explanation for that decline. Armstrong (1985, p. 136) was interested in the power relationships between the accounting, engineering and personnel professions within the corporation. He took the disappearance of the engineer as given and asserted that "accountants displaced engineers because decisions of allocation between dissimilar operations could only be made on a common abstract—and therefore financial—basis." He contended that since management responds most strongly to financial information, in the long-term struggle for power, the accountant would displace the engineer. With the accounting profession focused on income measurement, and with their production-oriented colleagues gone, it is not illogical that production-oriented measures would fall by the wayside.

CONCLUSIONS

The purpose of this paper was, in part, to remember those who measured operational efficiency earlier in the century. They accomplished this by spotlighting the idle time of machines and the idle capacity of the factory through a cost accounting system linked to production. Beginning in the 1930s, although interest in capacity never disappears entirely, there was a withdrawal from this topic. It was replaced by sales or marketing efficiency measures. Some of the possible reasons for this change were presented for future research. They included: the great depression, during which idle capacity was so prevalent that it hardly needed emphasis; the growth of trade associations which were given incentives to set price minimums; war contracts which reimbursed all costs and eliminated for many years the benefits of tracking idle capacity; an increasing interest in income measurement for financial accounting purposes which washed over management accounting and its literature; and the disap-

[17]This information was gathered by count. During these years, each article in the *NACA-Bulletin* was preceded by a short biography of the author which included his or her professional background.

pearance of the engineer from cost accounting which removed the party most interested in production.

Except for selected references, no attempt has been made to study the capacity issue past the 1960s. By then, enough of a transition had been made from operational to sales efficiency to substantiate this major change. Much of the literature at that time was appearing in *The Accounting Review* written by academics. Whether this academic influence might also have had a long-term effect on cost accounting practice is another topic for research.

While idle capacity as an independent topic may not be overwhelmingly appealing to many readers, this research finds that it opens a window on periods of accounting history that have been insufficiently studied, particularly the 1930s and 1940s. There was a major shift in the profession's understanding of overhead costing and the purpose of its allocations. That shift appears to have been generated by a variety of forces from within and without the profession.

Losing idle capacity measurements meant that information on machine usage and production opportunities as well as the location of bottlenecks in the production process was lost. The modern attention placed on minimizing non-value adding activities has revived interest in capacity issues. It is possible that guidance on how to approach these problems might be found in the solutions posed by early cost accountants and their peers, the industrial engineers.

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