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Plant capacity costs

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BY
GENE D. ARMSTRONG
Candidate for the Degree of Master of Science in Business Administration

Submitted to the University of Richmond School of Business Administration Faculty in July, 1957.

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INTRODUCTION

Plant facilities represent an investment that leads to continuing cost for taxes, interest, depreciation and maintenance. These costs are, for the most part, fixed. Consequently, the higher the volume of production attained with given facilities, the lower is the cost per unit of such overhead; conversely, as production falls off there are fewer units over which to spread overhead and unit costs rise. Thus idle capacity may result in "unabsorbed" overhead. Idle capacity may result from managerial inefficiency; therefore, executives should watch the extent to which capacity is utilized. The knowledge of idle capacity may enable corrective steps to be taken; advance information as to prospective idle capacity may make possible its prevention.

THE PROBLEM

Statement of the problem. The purpose of this study is to assemble and present information appertaining to plant capacity costs. The purpose is not to attempt to recommend any one solution to the problem, but, rather, to present the views of those authorities who have written and presented various methods of solving the problem as they see it, and to conclude with this writer's opinion.

Importance of the study. The goal of every factory manager is to operate his plant at a level of production which approximates full plant capacity. Idle capacity is a condition which applies to all types of business and may be reflected in higher prices paid by consumers, or may be borne by producers in the form of higher costs and smaller profits. While losses attributable to idle plant capacity cannot be eliminated entirely, they can be minimized through the analysis of situations in individual plants. If the concern is carefully departmentalized, cost accounting records can be prepared to reflect the cause and to determine the official or department responsible for the inefficiency. Idle machines and equipment can be reported for each department with a notation of causes.

DEFINITIONS OF TERMS USED

Normal capacity. The normal plant capacity is the "utilization of physical plant that is necessary to meet the average commercial demands over a period of time long enough to level out the peaks which come with seasonal and cyclical variations."[1]

Normal burden rate. A normal burden rate has been defined as follows:

> If the operations of a company or department are reviewed statistically for a full cycle of lean and prosperous years, and, on the basis of its being the average, as being representative of future expectancies, or on some other basis, a given annual output is selected as normal, the actual burden for that year becomes the normal burden. For recovery in costs it is usually expressed as a percentage of a factor included in the prime elements of cost, e.g., productive labor dollars, machine

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[1] Charles C. James, "Measuring Plant Capacity," The National Association of Cost Accountant's Bulletin, December, 1934, p. 356.

hours, tons output.[2]

Idle capacity. The idle plant capacity "represents the average unutilized portion of the plant and equipment over a long enough period of time to level out the peaks and valleys which come with seasonal and cyclical variations."[3]

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[2] Fred V. Gardner, Variable Budget Control. (New York: McGraw-Hill Book Company, Inc., 1940), p. 203.

[3] James, loc. cit.

CHAPTER II

NORMAL PLANT CAPACITY

Some accountants believe that the actual costs of plant operations are not necessarily the best criteria of true cost, that the proper amount of burden to be charged to the product is the amount incurred at normal capacity which involves normal production and normal expenses.

Purposes of normal capacity. The main purposes of normal capacity are:[4]

(1) Establishing standard costs for pricemaking.

(2) Planning sales and production.

(3) Determining the profit-realization point.

(4) Providing plant balance.

(5) Assisting in allotment of volume.

Establishing standard costs for pricemaking. Assuming that it is true that all productive enterprises are initially promoted and continue to exist to meet potential market demands, the correct basis to be used in determining standard processing costs is normal capacity. In making this statement, it is taken for granted that the enterprise must serve the needs of the industry of which it is a part as such needs are developed or disclosed by the sales

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[4] James, op. cit., p. 364

department. Under this condition normal output must be determined by the long-term average distribution of products as forecast from sales analysis and market research. This may be the basis on which General Motors Corporation computes its costs and prices its products.

The Ford Motor Company may use an alternative which is based on the premise that the present plant and equipment represents the controlling capacity of the enterprise. Costs would be computed and prices set which were derived from the full physical utilitization of the facilities that have been provided. Thus, it is the responsibility of the sales department to obtain distribution accordingly.

In determining which method is to be used, each case must be decided after a study of the conditions peculiar to that particular industry. In one case the factory serves the demands of the sales department. In the other case, the sales department serves the factory. Each business should definitely decide to use one method or the other as a mixture is not feasible and could possibly lead to disaster on the profit and loss statement.

Planning sales and production. The use of two dissimilar situations in our industrial world will serve to illustrate the significance of the relation between sales and plant capacity. Contrast the situation during the war when capacity was inadequate with the days of the great depression when capacity was far above needs.

Sales are not limited by inadequacy of capacity but by the lack of buying power. Sales emphasis, however, must be so guided as to insure the working of the greatest amount of capacity even though it means a greater effort on the sales force who are ever prone to sell the easiest line regardless of the capacity costs that lurk in the manufacturing process.

From this, it follows that unless care is given to projecting lines of sales in terms of operating capacity, cost will involve uncollectible charges from idle capacity where utilization is uneconomically low, while other processing operations will demand serious overpressures on other divisions of the plant.

Determining the profit-realization point. The concept of "break-even" point is one of the most useful that has entered the practice and procedure of modern budgeting. In practical application, it calls for the determination of the point where income and expenses balance. Below that point there is a loss; above that point, a profit. It is clearly evident that this profit-realization point, which is usually expressed in sales volume, corresponds to a certain amount of product at certain prices. This volume of product, in turn, is a certain determinable part of plant capacity. That is to say, from our capacity point of view, the plant is burdened in each of its divisions with fixed charges which, in turn, demand a definite output in order to supply a volume of product whose sales income will exactly balance expenditures.

Volume of production necessarily is affected by price levels that are influenced by outside competition. Lower prices may increase production volume, indeed, they may bring utilization very close to operating capacity and yet because of low prices, the break-even point may become so high that profits are not realized. In contrast, our price level may be too high with corresponding smaller volumes and greater idle capacity costs. Here again we find the break-even point too high for a favorable profit condition.

Providing plant balance. In the main, this calls for the proper scheduling of orders through the plant. Engineering studies which lead to a careful consideration of length of runs, set-up costs, and machine tool layouts are of great importance in reaching an improved condition where the plant is in better balance with production. Such studies should lead to the reduction of many idle capacity costs.

The maximum production of a shop is the maximum production of its "bottle-neck" for the same reason that the chain is as strong as its weakest link. In a steel mill, for example, the speed and capacity of the rolls usually control the output of the furnaces and the volume of the finishing operation.

The production of individual departments, machines, or processes must be severally synchronized with the aggregate output of all. To illustrate: If the overall capacity of an entire plant is 80 percent of maximum capacity, this is the percentage that will apply to its key operations. Feeder operations will average, more or less, accordingly as they are overbalanced or underbalanced. For example, an automatic screw machine might have capacity for producing double the number of screws that could be used in assembling the factory's present product. Its normal capacity would then be half that of the overall average, unless a part of its production could be sold outside. Finishing processes must be "normalized" by similarly relating them to controlling operations where they themselves are not the controlling factors.

Where a battery of like purposed machines are available for service, they make up a production or cost center. Their aggregate normal production determined their normal capacity as an integral unit, with differing individual standards only so far as necessary to permit a more intensive use of the more economical or efficient unit.

Capacity and allotment of volume. Coming under government restrictions is the ever present problem of production control. Any limitation of volume and any allotment of the curtailed volume among individual concerns constitutes one of the most involved and difficult problems to be worked out for each industry.

What part shall the capacity of a given factory play in determining the share it shall receive of the total amount to be produced by the industry? Let us briefly study the accompanying table (figure 1) which shows the problems of allotment when consideration is given to factory capacity.

It is quite obvious that the two large companies, in contrast with the three smaller companies, would emphasize the needs of factoring capacity, while the other three concerns would stress past sales as more important.

FIGURE I
ALLOTMENT OF VOLUME

	Maximum Capacity			Average Past Sales	
Company	Number of Units	Per Cent of Total	Number of Units	Per Cent of Total	Per Cent of Capacity
A	2,500	37.4	800	36.3	32.0
B	2,100	31.3	550	25.0	26.2
C	1,100	16.4	400	18.2	36.4
D	600	8.9	270	12.3	45.0
E	400	6.0	180	8.2	45.0
	6,700	100.0	2,200	100.0	----

Source: Charles C. James, "Measuring Plant Capacity," The National Association of Cost Accountant's Bulletin, 16:369, December, 1934.

Advantages of normal capacity. There are many advantages that adhere in the concept of normal capacity. The two main advantages are:

(1) Elimination of fluctuations in costs due to volume factor.

(2) Establishing sound cost estimates.

The elimination of fluctuations in costs due to volume factor. Surely the outstanding advantage arising from this concept is that normal capacity tends to eliminate fluctuations in cost due to volume factor. In addition, its use tends to prevent the overexpansion of plant capacity. When the broader economic viewpoint is taken out, and the capacity of the public to consume the output is considered as well as the ability of the firm to produce, this is particularly true. There are already too many industries in which the ability of the public to consume the production has been ignored, resulting in a tremendous overexpansion of plant capacity. This is inexcusable in most cases, and has resulted in direct losses to the owners of the business involved, as well as an economic loss to the general public. An analysis of normal capacity will disclose excess and idle equipment in many factories, and will enable management to plan production over longer periods, thereby reducing costs and releasing additional equipment for other uses. This excess equipment is costly, and has, at times, been the direct cause of business failures. It is a fairly safe assumption that a large percentage of American business firms could dispose of substantial quantities of equipment if peaks and valleys in production could be leveled off. This could be done, partially at least, through a proper and complete analysis of normal capacity and normal public needs.

Establishing sound cost estimates. You can automatically establish sound cost estimates which, in turn, enable industry to establish and maintain a sound price structure by using this normal volume which reflects normal burden over a period of years. This will tend to eliminate cut-throat and ignorant competition. All of this tends to maintain a more consistent level of production and employment and adds greatly to the welfare of the people.

By establishing cost on the basis of this normal volume and thereby obtaining more scientific costs with due consideration to long term cost trends, the management is in a position to be more selective in obtaining business for their plants. This will also tend, in the long run, to stabilize profits and employment. In connection with this whole question of normal capacity and its effect upon cost and selling prices, it must be remembered that when prices are either arbitrarily reduced or, through ignorance of normal capacity and normal overhead, are placed at a point below the cost at which the product may be produced over a period of years, the concern responsible for the price cut has not only reduced its own profits but has also destroyed a profitable line for all industry. It has created a situation wherein it sometimes becomes impossible to increase the price structure even after business has again reached normal. This is a concept which is too often ignored by those who are responsible for the setting of selling prices.

The alternatives for normal capacity are (1) guesswork; (2) considering only the "peak capacity" to produce, ignoring the ability to sell and collect; and (3) considering only "normal capacity" to produce, ignoring the ability to sell and collect.

Capacity relationships. Before continuing the discussion of normal capacity, the relationships between the various plant capacities must be firmly entrenched in the mind of the reader. The plant capacity relationships are illustrated in figure 2.

"The theoretical, or maximum capacity of a plant or department to produce would be that achieved under 100 per cent operating time. This involves no delays of any kind and is, quite obviously, not achievable. It is represented on the chart by the line AB. Practical plant capacity is the maximum capacity less operating interruptions. This represents practical utilization of the physical plant, without regard to commercial demands. Thus it is represented in the chart by the line AC, which is maximum plant capacity (line AB) less operating interruptions (line CE).

Idle capacity is the unused portion of the plant and equipment, due to lack of customer demand (line CD). Capacity based on sales expectancy (line AD) is measured by the productive equipment required to meet the average commercial needs over a period of time. On the chart, this is the difference between practical operating capacity (line AC) and idle capacity (line CD)".[5]

Normal capacity bases. "There are two different points of view regarding the basis on which normal capacity should be determined. The first is that the normal capacity base should be the ability of a plant to produce. The second is that normal capacity should be founded upon expected utilization of the plant to meet expected sales over a period of years in the future. The former concept is often spoken of as

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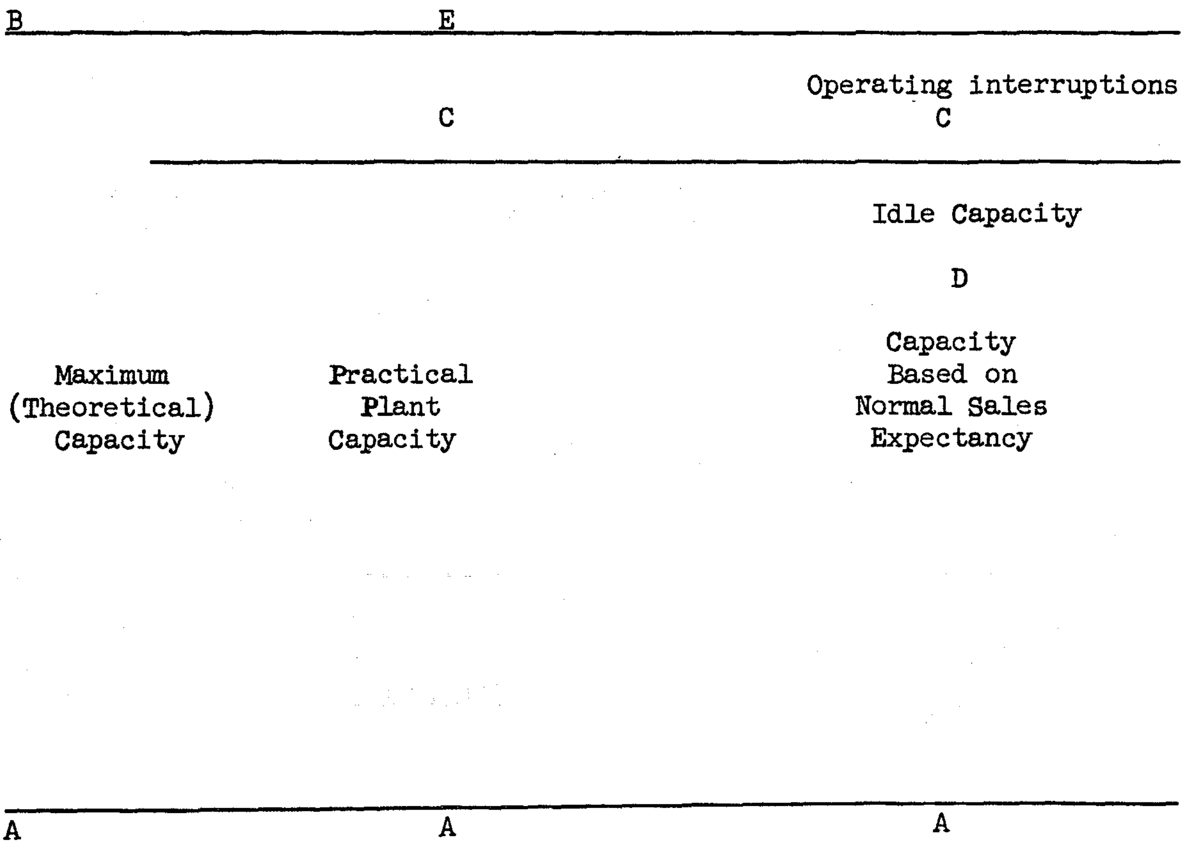
[5] Charles C. James, "Capacity, Cost, and Prices," The National Association of Cost Accountant's Yearbook, 1945, p. 41

'practical capacity,' while the latter is generally alluded 'normal sales expectancy'."[6]

FIGURE 2
CAPACITY RELATIONSHIP



Source: Charles C. James, "Capacity, Costs, and Prices," The National Association of Cost Accountant's Yearbook, p. 41

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[6] J. Brooks Heckert, "Normal Overhead and its Significance in Pricing," The National Association of Cost Accountant's Yearbook, 1939, p. 310.

Practical capacity. There are a great many plants that use practical capacity as a basis for setting normals. The use of normal capacity based on the practical operating level in cigar manufacturing is illustrated in figures 3 and 4. Figure 3 shows the computation of normal capacity (in hours per year), with an 8 per cent deduction from the theoretical maximum for operating delays. The resulting figure is applied to the number of machines available for producing different shaped cigars (figure 4). Multiplying the production per hour for each machine by the normal number of hours as determined in figure 3, gives normal capacity for each kind of cigar, expressed in units of physical product. For cabinet cigars, 78 machines x 457.1 production per hour times 2,179 normal hours per year equals 77,689,630 cigars, normal capacity on a practical operating level.

These figures are then converted into departmental normals, by computing pounds of tobacco and labor cost for the normal production. Normal expenses are estimated from departmental budgets on the basis of a departmental production schedule. Then, normal expense divided by standard direct labor obtained from production schedule, yields the normal rate in per cent of direct labor cost.

"In the Electrical Manufacturing Industry, the amount of reduction from theoretical capacity to normal capacity based on the ability of a plant to produce is usually from 15 to 20 per cent."[7]

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[7] C. Howard Knapp, "Problems in the Application of Uniform Cost Accounting Methods," The National Association of Cost Accountant's Yearbook, 1934, p. 127.

FIGURE 3
NORMAL PRODUCTION HOURS

Normal Production Capacity

Total days in year	365
Less 52 Sundays, 11 holidays and 6 days of inventory closing	69
Schedule working days for year	296
Average hours per day (5@8 3/4; 1@4 1/4)	8
Annual schedule hours - gross	2368
Machine repairs, adjustment, and overhauling 8%	189
Net Annual Schedule Hours	2179

Source: C. Howard Knapp, "How to Determine Costs on a Predetermined Sales Forcast," The National Association of Cost Accountant's, 14:914, February, 1933.

In the definition of cost for the Hosiery Industry, the normal volume is found as follows:

1. From the 52, 80 hour week of the year, or other provisions for the operation of productive machines as may be provided by amendment to the code, deduct legal holidays and the time allowed for taking inventory in order to determine the maximum possible time that the knitting department would be devoted to production, and express the result in terms of total production hours.

2. Compute total maximum production that the knitting departments are capable of accomplishing in the total productive hours, and consider this the maximum capacity of the mill.

3. Normal capacity will be stated as 75% of Maximum capacity. The deduction of 25% is to provide for loss of time due to breakdown, pattern changes, making samples, seasonal fluctuations and other causes. In any case where a mill's total production has exceeded 75% of the maximum capacity for the previous fiscal year,

the actual percentage of maximum capacity so attained may be used in place of the 75% otherwise specified.[8]

In another industry, normal operations of the individual producer for any semiannual accounting period might be determined by taking not more than 65 per cent of the best six consecutive month's production of such individual producer (practical capacity) since January 1, 1924, and for any quarterly accounting period, one-half of such amount.

Normal sales expectancy. The use of capacity to sell as a basis for normal burden absorption in the linoleum industry is explained by Patterson,[9] who shows how to arrive at normal volume for the application of manufacturing expense.

First, he believed, there must be determined what has been called "potential operating capacity," i.e., the capacity to make, taking into consideration the necessary allowances for the machine changes, and for the down time.

Then, the normal sales figures were estimated. These normal sales were usually tied-in with the sales for the industry as a whole. It was necessary to come to some conclusion as to the relative position this business had in its industry, which may have been based on relative capacity to produce, or upon a demonstrated ability to sell. The trend in general business and in

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[8] Ibid., p. 128.

[9] T. H. Patterson, "Practical Standards for Manufacturing Expense," The National Association of Cost Accountant's Bulletin, February 1, 1935, p. 657.

FIGURE 4
COMPUTATION OF NORMAL MACHINE CAPACITY

Machine Capacity - Normal Schedule

Kind of Cigar	Number of Machines	Production per 8 3/4 hour day	Production per Hour	Yearly Machine Production: Normal Net Schedule 2,179 hours per machine	Yearly Machine Production: Annual production (thousands)
Blk. Londres	22	4,000	457.1	47,938	21,912
Perfecto	8	4,000	457.1	17,432	7,968
Cabinet	78	4,000	457.1	169,962	77,690
Panetela	4	4,000	457.1	8,716	3,984
Endicott	12	4,000	457.1	26,148	11,952
Midget	22	4,000	457.1	47,738	21,912
Junior	8	4,000	457.1	17,432	7,968

Source: C. Howard Knapp, "How to Determine Costs on a Predetermined Sales Forecast," The National Association of Cost Accountant's Bulletin, 14:914, February 15, 1933.

this particular industry was then determined, and a forecast made of the probable normal sales volume for a period of from three to five years. The percentage of the total industry represented by this business was then expressed in sales units, which, to all intents and purposes, was the normal sales volume.

The normal sales volume thus arrived at may be thought of as burden absorptions points. When setting these burden absorption points, it is good practice to see that the manufacturing and sales department heads, as well as the cost department, are familiar with the estimated volume. In the business under observation, these fixtures are published yearly, and the volumes are not changed until there is an authorized revision of either the capacity or the burden absorption points.

> It seems that the logical time to review the burden absorption points is during the period when the forecast for the coming year is being prepared. This forecast was built upon the current conditions in the industry, which were known and the expected conditions for the next twelve months, both of which were more definite then an estimated trend for three to five years in the future, used in determining normal sales. With the forecast available, it is sometimes advisable to modify the normal sales volume; however, for the period considered herein the normal sales volumes selected were believed to be reasonable, and the volumes were not reduced because the current forecast happened to be lowered. At that time, the comparison of production and sales possibilities showed the following:

	Capacity Units	Normal Sales Unit	% Normal Sales of Capacity	Budgeted Volume Unit
Commodity A	1,500,000	1,000,000	66.7	750,000
" B	2,000,000	1,000,000	50.0	600,000
" C	500,000	350,000	70.0	250,000

> The figures listed under "Normal Sales," it should be noticed, are the average expected sales for a period of from three to five years, while the figures under "Budgeted Volume" are estimates of the sales for the next twelve months and may vary considerably from the normal sales forecast. The procedure in this particular business was to accept the normal sales volume as the basis for burden absorption, inventory valuation, and for routine estimates. However, the sales manager was given cost information for catalog items which showed the total cost absorbing all factory burden at the forecast volumes. This particular information can be developed quickly from standard costs at normal sales volume.[10]

Measurement of plant capacity. The capacity of a plant must be measured according to what is a customary length of working day for the machinery, which may be anything from eight hours a day to twenty-four. Thus in a plant where eight hours is the standard operating day, normal capacity would mean eight hours output, and this could be increased by putting on a second and a third eight-hour shift, while a plant already working two shifts does not have the same reserve for producing. The same principles apply to standard or satisfactory speed, meaning, as nearly as can be determined, the maximum speed which pays in the long-run to try to maintain. Presumably, the ideal of the efficiency engineer would be the highest speed that could be maintained year in and year out, that is, without producing cumulative fatigue; but nobody knows exactly what this is, and working estimate needs must be governed by customary practice.

The normal capacity should be determined, first, for the business as

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[10] Ibid., p. 664.

a whole, and then broken down by plants and departments. In a purely jobbing industry, each department could be treated as a business by itself and normal capacity accordingly.

This capacity may be stated in terms of labor hours, machine hours, production units, sales value, tonnage, etc., depending upon the nature of the business. Each industry has its own yardstick. In one industry, it might be tonnage miles or passenger miles, while in another, it would be sales value, etc.

James,[11] states that capacity, utilized and unutilized, may be measured in the two following ways:

1. Physical output.

2. Productive effort.

Physical output. In a company that produces a single uniform product, it is sometimes convenient to measure potential-operating capacity, peak-demand capacity, normal capacity, and excess capacity in units of volume of output; barrels of flour in a flour mill; tons of steel in a steel mill, etc.

When there is a diversified product manufactured from a single raw material, it is often expedient to measure the capacity in units of raw material such as the number of animals slaughtered in a packing plant. Yet again, the most practical measure might be found in some intermediate stage of conversion such as the gallons of pulp from the beaters in a paper mill.

The aggregate physical output is manifestly controlled by whichever

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[11]Charles C. James, "Measuring Plant Capacity," The National Association of Cost Accountant's Bulletin, December 1, 1934, p. 372.

group of machines having the lowest proportional volume of physical capacity. For example, if a factory equipped with one of the large new style, automatic box machines, with a rated output of 140 boxes a minute, has three filler machines rated to turn out fifty a minute each or 150 a minute for the three, it is apparent that the filler machines overbalance the box machine in the ratio of 150/140. So small a disparity might very well be absorbed in costs. But, if the factory has only two filler machines rated to turn out a combined 100 a minute, then the box machine would overbalance the filler machines in the ratio of 140/100. In the latter case, the box machine could be utilized for only 100/140 of its productive capacity and therefore 40/140 of its fixed expense should be classified as "excess plant expense."

Actual tests of operations may disclose that when running full time the actual output averaged 80 per cent of the rated output. Potential operating capacity would therefore be 80 per cent of the rated output of the "Bottleneck" operation.

It is very seldom that such perfect balance as 4:2:1 or 5:3:2 is achieved in a given plant. The external balance[12] decisions invaribly lead to fractional machine requirements and make it impractical to apply an ideal ratio. The same difficulty is encountered in balancing manpower along conveyors. The balancing of such work requires its sub-divisions

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[12] The external balance of equipment equates total capacity with a predetermined level of sales volume.

so that each operator takes approximately the same time to perform his assigned task, since the conveyor moves the work past all operators at the same speed. If the productive capacity at one stage of the process is insufficient for the volume produced in earlier stages, there results a "bottleneck." If the productive capacity at any stage is so great that it is never fully utilized, there also results unbalance. Although not brought so forcibly to the attention of management, such unused capacity is costly.

Productive effort. In a factory converting diversified materials into a variety of products, there is no physical unit to provide a uniform measure. Here, except in the most highly mechanized processes, all work is carried on under the control and will of individual workers. For the most part, all mechanical apparatuses and all power distribution and control systems serve the purpose of increasing the skill and productivity of the worker. Hence it follows that all tools and equipment take their pace from him who uses them. They are idle when he is idle. Therefore, the standard direct labor hour is the greatest common denominator of miscellaneous shop activities.

A machine shop in which various sizes of iron, steel and brass castings are fitted for assembly into valves, pumps, and hydrants, which is equipped with machine tools will be taken to illustrate the practical application of determining maximum, peak-demand, normal and excess capacity on the basis of productive man hours (figure 5).

In the column which is headed "Maximum Use" has been entered for each machine the number of hours per week it will be in use when the company's foundries are running at their maximum capacity.

In the column headed "Required Economical Use" has been entered the number of hours per week each machine must be operated on the average when the foundries are running at their maximum capacity if the installation of the machine is to be justified as an economical tool. For example, the three engine lathes in Group 1, being standard machines of equal servicability, must be operated full time to warrant having them at all, while the Meriden forming lathe in Group 2, being a special purpose machine, will justify its keep if it is in use half the time during which the shop is working.

Consideration has been given to many factors in arriving at this required economical use for each machine. For one thing, alternative methods of producing the same results may bring up the required minimum use to above what their more convenient use would entail.

In the column headed "Peak Demand" has been entered for each machine the estimated number of hours per week it will be in use to meet maximum commercial demands for the product of the plant.

In the column headed "Excess Machine Time," has been entered the number of hours per week each machine's operating time during peak demands on the shop falls short of its required economical use.

FIGURE 5
PRODUCTIVE MAN-HOURS OF MACHINE TOOL USE - WEEKLY

Productive Man Hours of Machine Tool Use - Weekly

Machine Number	Description	Maximum Use	Required Economical Use	Peak Demand	Excess Machine Time	Normal Use
	Group No. 1					
101	American Engine lathe 18"x12"	40	40	24	16	18
109	American High Duty lathe 18"x12"	40	40	24	16	18
110	American High Duty lathe 16"x12"	40	40	24	16	18
		120	120	72	48	54
	Group No. 2					
305	Meriden Forming lathe	30	20	10	10	8
	Group No. 3					
308	American Turrent lathe 24"	36	24	18	6	14
309	American Turrent lathe 24"	20	24	10	14	7
		56	48	28	20	21

Source: Charles C. James, "Measuring Plant Capacity," The National Association of Cost Accountant's Bulletin, 16:376, December 1, 1934.

In the column headed "Normal Use" has been entered the number of hours per week each machine will be in use to meet average demands, as determined by past experience modified to take account of changing trends in the company's industry, and by the probable average future consumption of the company's products as forecast from market surveys.

Excess plant expense is the amount by which lowest attainable machine and equipment expenses exceed economical costs, and may be computed as the percentage of budgeted plant expense by which required economical use exceeds peak demand use, if any.

CHAPTER III

NORMAL BURDEN RATES

As it was intimated in the last chapter, normal capacity should be the foundation for burden accounting. Burden should be determined on the normal capacity volume, and all comparisons of actual overhead should be made by this normal. This is especially true in a business enterprise such as an ice cream plant or a coal mine. It is obvious here that if burden costs are not applied to production by means of normal distribution rate, production completed during months of low activity will have a larger amount of overhead applied to them than will production completed during the months of high activity. Manifestly, if overhead distribution rates are computed separately for each month, unreliable costs will result.

Applying normal burden. There are numerous methods by which normal overhead can be applied to production. Those most frequently used are:

1. Standard direct labor hours.
2. Standard machine hours.
3. Standard productive hour rate.

Standard direct labor hours. The standard direct labor hour method is illustrated by Spitznas[13] through its use in a brewry.

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13 C. Thomas Spitznas, "A Standard Cost System for a Brewry", The National Association of Cost Accountant's Bulletin, June 1, 1939, p. 1243.

The Stantom Brewing Company, which had recently installed a system of standard costs in its plant had the following balances in its operating ledger:

General Ledger Control		$56,306.27
Finished Products-Brewery	$21,542.50	
Finished Products-Bottling Dept.	28,652.76	
Stores Inventory	9,156.76	
Operating payroll		3,045.75
	$59,352.02	$59,352.02

The plant had a capacity great enough to produce 50,000 barrels of beer per year, and, at that time, the demand for the beer would justify operating at full capacity. It was estimated that it required twelve men an average of forty hours per week, or a normal operating level of 2,080 hours per month.

Figure 6 shows the monthly budget for the bottling department. A separate variable budget was set up for general overhead, and such overhead expense at normal was redistributed to each producing department. In this case $1,664.00 was allocated to the bottling department.

The standard direct labor hour rate for the bottling department was then found as follows:

$$\frac{\text{Normal direct overhead - allocated general overhead}}{\text{Standard direct labor hours}}$$

= Standard rate per direct labor hour

$$\frac{\$3,120 - \$1,664}{2,080 \text{ hours}} = \$2.30 \text{ per standard hour of direct labor}$$

This method of applying burden cost is ideally adapted to those plants where labor constitutes the most important cost element. Since most factory overhead costs accrue on the basis of time, the standard labor-hour method is, according to Blocker,[14] the most logical method of apportioning factory overhead to production.

Standard machine hour method. In plants that have huge sums of money invested in machinery, the machines may constitute a more costly element than labor. It follows, then, if such is the case, that the most logical method of apportioning factory overhead to production is on the basis of standard machine hours.

The standard machine hour method is best illustrated by Peden[15] through its use in the manufacture of plastic molded parts.

At the end of a five month period of time, which was allowed to elapse before computing the normal burden rate, a study was made of the production for that period, and a comparison was made with the volume for the corresponding months of the first year. Three of the months represented summer production of low activity, and two of the months represented winter production of high activity. Accordingly, a calculation was made on the assumption that a normal year's business would consist of seven high months and five low months. The burden rates for the departments were then determinded in the following manner:

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[14] John G. Blocker, Cost Accounting (New York: McGraw-Hill Book Company, Inc. 1948); p. 231.

[15] Robert W. Peden, "Cost Accounting in the Plastic Molding Industry," The National Association of Cost Accountant's Bulletin, January 1, 1939, p. 531.

Months of Low Production	Actual Burden	Actual Machine Hours	Actual Cost per hour
August	$ 5,210.98	1,310	$3.98
September	3,160.42	1,140	2.77
October	4,810.96	1,317	3.65
Total	$13,182.36	3,767	$10.40
Average	4,394.12	1,255.6	3.47
Months of High Production			
November	$ 8,210.95	5,233	$1.57
December	7,922.40	5,014	1.58
Total	$16,133.35	10,247	$3.15
Average	8,066.67	5,123.5	1.575
1. 7 x High Averages	56,466.69	35,864.5	1.575
2. 5 x Low Averages	21,970.60	6,278	3.47
3. Annual Total	78,437.29	42,142.5	1.8612
4. Burden Rate Adopted			1.85 per hour.

Although such a policy obviously meant the absorption of a certain amount of idle expenses as an operating cost, the officials of the company felt justified in making the decision. They believed that the cost and price structure should be so arranged that an ample profit could be made in the months of high production and an "even break" or better obtained during the low period of each year.[16]

A second illustration of the standard machine hour method is given by Sawyer[19] through its use in the dyeing and printing of cotton fabrics.

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[16] Ibid., pp. 534-535.

[17] Lewis F. Sawyer, "Standard Cost in Dyeing and Printing of Cotton Fabrics," _The National Association of Cost Accountant's Bulletin,_ June 1, 1933, p. 1443.

FIGURE 6
MONTHLY BUDGET OF DIRECT OVERHEAD EXPENSES

Bottling Department

Expense Items	80%	85%	90%
Supervision			
Indirect Labor			
Crowns, Labels, etc.			
Supplies and Expense Miscellaneous			
Water, Light and Power			
Repair to Machinery			
Repairs to Building			
Depreciation-Machinery			
Depreciation-Building			
Insurance			
Taxes, Property			
Total	$2,514.00	$2,642.00	$2,863.00

Source: C. Thomas Spitznas, "A Standard Cost System for a Brewery," The National Association of Cost Accountant's Bulletin, 20:1251.

The number of machines comprising each process center, multiplied by the daily plant operating time and by the standard per cent of operations, equals the daily standard operating hours which should be divided into the process budget per day for the standard hour rate. This is illustrated in figure 7. Thus for Singe: 2 machines x 10 hours x 75% = 15 hours, normal per day. The normal overhead budgeted per day divided by the normal operating hours gives the standard machine hour rate for the process. For Singe: $30.75 normal budget per day divided by 15 hours, normal operating time, equals $2.05 per standard machine hour. This machine hour rate divided by the standard operating speed yields the standard cost per 1,000 yards for overhead. For Singe: ($2.05 ÷ 4,000) x 1,000 yards = $0.5125, overhead product cost per 1,000 yards.

"The standard machine hour method is not very well adapted where a single overhead distribution rate for an entire factory is desired; it is used more satisfactorily where plants are departmentalized and a rate for each department is required".[18]

Standard productive hour method. "Under this method, the standard rate for overhead per hour in each cost center is combined with a standard rate per hour for direct labor to obtain a standard operating cost rate. Thus an inclusive cost rate is obtained for each cost center which may be applied to all products on which work is performed."[19]

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[18] Blocker, loc. cit.

[19] Theodore Lang, Cost Accountant's Handbook. p. 1090.

"The standard production hour is the standard amount of product that is to be turned out in an hour at every operating or cost center."[20] He believed that with the determination of this standard amount of product which should be produced in a given time that management would have available the normal volume within their plant. If this is true, the standard productive hour forms the basis upon which budget allowance for all overhead should be based. Thus, when the number of standard productive hours fall, a definite budget allowance for all expense is automatically set up for the curtailed production is speeded up beyond the normal, a specific budget is available for that situation.

The standard overhead expense rate is obtained by taking the direct expense of a cost center and adding to it the cost center's share of the general overhead expense (both at normal capacity). If the monthly total of these two expenses is divided by the standard hours of normal capacity, this is the standard overhead rate per hour. To this is added the standard labor rate per hour and the resulting figure is the standard productive hour rate.

Separate rates for fixed and variable overhead. Some accountants believe that separate rates should be obtained for fixed and variable overhead. They contend that the fixed expense should be considered a capacity expense, while the variable expense should be considered an

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20 Charles Reitell, "The Standard Cost Plan for The N.A.C.A. Company," The National Association of Cost Accountant's Yearbook, 1931, p. 20.

activity expense. This belief is based upon the fact that the fixed expense of any service department is dependent, at any given time, on its capacity to serve, but that this capacity to serve is related to the capacities of producing departments to operate. They contend, therefore, that the fixed expense of service departments should be distributed in the ratio of capacities, not according to the rate of operations. "On the other hand, variable expenses are occasioned by the extent to which activity occurs; this, then, becomes the basis on which such expenses should be distributed."[21]

Segregation of fixed charges. The segregation of fixed charges is illustrated by Patterson in connection with power cost:

> From past experience, it is known that the following consumption of power (including line loss) will be required for the production selected:

Commodity	Production Sales (Normal Sales)	Kwh
A	1,000,000	15,000
B	1,000,000	30,000
C	350,000	90,000
Mechanical Shops	...	5,000
Steam Plant	...	1,000
General Factory	...	4,000
Total Kwh. required	...	145,000
Cost per kwh.		$ .03
Total purchased power		$4,350.00
Electric light		200.00
Total		$4,550.00

[21] Charles F. Schlatter, "Distribution and Controlling Overhead," The National Association of Cost Accountant's Bulletin, November 1, 1935, p. 235.

FIGURE 7
CALCULATION OF COST STANDARDS

Plant Operating Time 10 Hours.

Process	Machines	Standard per Cent	Standard Hours	Budget per Day	Machine Rates Burden	Machine Rates Labor	Class	Speed	Standards (Per M Yards) Burden	Standards (Per M Yards) Labor
Grey Storage			10	$ 74.36	$7.440		All	30,000	$.2480	
Singe	2	75	15	30.75	2.050	$.30	"	4,000	.5125	$.075
Bleach, Kiers	10	150	150	275.20	1.840	.10				
Bleach, Open	30	150	450	127.33	.283	.04				
White Driers	4	95	38	98.52	2.540	.43	"	4,800	.5290	.090
White Tenter	1	75	7.5	15.00	2.000	.37	1	1,500	1.3333	.246
							2	1,000	2.0000	.370
							3	500	4.0000	.740
White Winders	2	60	6	3.36	.560	.24	N	4,000	.1400	.060
							W	3,000	.1867	.080
Printing	8	95	76	601.92	7.920	2.38				

Source: Lewis F. Sawyer, "Standard Costs in Dyeing and Printing of Cotton Fabrics," The National Association of Cost Accountant's Bulletin, 14:1447, June 1, 1933.

Included in the above rate of $.03 per kwh. is the demand charge totaling $500 per year. The demand charge and the current used for lighting are considered fixed; therefore, the total purchased power and light is separated into $700 fixed, and $3,850 variable.[22]

<u>Distribution of fixed and variable charges.</u> The effect of using a single rate of distribution is compared with those obtained by using a double rate by Schlatter in connection with the distribution of power expense:

This illustration assumes that the power plant has just sufficient capacity to supply power to the two consuming departments when both are working at their full capacities. Power consumption at full practical capacities are assumed to be 15,000 units and 10,000 units for Department I and II, respectively. When the departments are working at less than capacities and not in capacity ratios, the following distributions result:

Consumption of Power	Units
Department I	12,000
Department II	4,000
Total	16,000

Power Expenses:	
Fixed Expenses	$5,000
VariableExpense	1,600
Total	$6,600

Distribution

A.	On the single base method: (Consumption ratios)		
	Burden Department I (12/16 of $6,600)	$4,950	
	Burden Department II (4/16 of $6,600)	1,650	
	Power Expense		6,600
B.	On the double base method:		
	1. Fixed Expenses: (Capacity ratios)		
	Burden Department I (15/25 of $5,000)	3,000	
	Burden Department II (10/25 of $5,000)	2,000	5,000
	2. Variable Expenses: (Consumption ratios)		
	Burden Department I (12/16 of $1,600)	1,200	
	Burden Department II (4/16 of $1,600)	400	
	Power Expense		1,600
			$6,000

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[22] Patterson, <u>op. cit.</u>, pp. 662-663.

> In this case, the two methods get decidedly difference results. The single base method charges Department I with $750 more, and Department II with $750 less than the double base method charges. The single base makes Department I pay a penalty for the greater idle time in Department II.[23]

Disposal of under or overabsorbed overhead. If normal rates are correctly set, variations are caused by off-normal operating conditions. These variations are usually analyzed according to volume variances and controllable variances.

"A number of practices exist regarding the disposal of these variances. The most frequently used are:

1. Adjust the cost of sales.
2. Write off to profit and loss.
3. Adjustment of gross profit.
4. Carry to a reserve account.
5. Adjust cost of sales and inventory on a pro-rata basis."[24]

The extent to which these methods are employed is shown in figure 8.

Concerning this matter of disposing of over-or under-absorbed burden, Downie, in an article discussing the disposition of unabsorbed burden, says:

> If normal burden rates have been properly established, they represent all the burden cost that production should be charged with. They represent all the burden cost that the sales department can sell. Any unabsorbed portion is due to factors other than production. As such, it is entitled to no place in the inventory for it adds nothing to the market value of such inventory values. Any resulting unabsorbed burden will be charged

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[23] Schlatter, op. cit., pp. 230-240.

[24] Downie, op. cit., p. 9

> directly to cost of sales as a specific item. Such a method will reflect a proper balance sheet at all times, and will show "unabsorbed burden" as a specific item in the profit and loss statement.[25]

Most accountants will probably agree that this is the theoretically correct method, but a second glance at figure 8 shows that more of them are moved to employ a more practical method that requires less work.

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25 *Loc. cit.*

FIGURE 8

SUMMARY OF METHODS OF DISPOSING OF OVER AND UNDERABSORBED SHOWING NUMBER OF COMPANIES USING EACH METHOD

Method of Disposing of Over- and Underabsorbed Burden	Overabsorbed Burden		Underabsorbed Burden	
	End of Year Treatment	End of Month Treatment	End of Year Treatment	End of Month Treatment
1. Balance overabsorbed treated as a reserve; balance underabsorbed charged against reserve or carried forward	9	35	10	37
2. Balance overabsorbed credited to cost of goods sold; balance underabsorbed debited to cost of goods sold	65	38	72	39
3. Balance overabsorbed shown separated as deduction from cost of goods sold; balance underabsorbed shown separately as addition to cost of goods sold	59	46	62	46
4. Balance overabsorbed treated as other income below gross profit; balance underabsorbed charged to profit and loss below gross profit	57	52	58	53
5. Balance over-or underabsorbed divided pro rata between inventories and cost of goods sold	10	7	8	1
6. Unclassified		3		3
Totals	209	181	210	179

Source: Raymond P. Marple, Director, "Finished Goods and Inventory Practice," The National Association of Cost Accountant's Bulletin. Research Study, 21:943, March 15, 1940

CHAPTER IV

IDLE TIME AND CAPACITY

Smaller profits are due primarily to low production. While idle time costs are more evident during periods of low activity, they are always present. Excess capacity, variations in seasonal demand, and machine breakdowns must always be considered in matters ofprice policy. Some idle time costs are recoverable through price, while others are not. Increasing emphasis is being placed on the interpretation of operating figures with a view to measuring the performance of the various operating heads from the foreman up. This involves the segregation of noncontrollable items from those which management may be held responsible. There are no costs which are more likely to upset this type of analysis than those which stem from the various causes of idle time.

Causes of idle time. There are myriads of idle time causes; these have been classified into three main groups as follows:[26]

1. Administrative
2. Production
3. Economic

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[26] Wyman P. Fiske, "Accounting for Unused Facilities," The National Association of Cost Accountant's Bulletin, November 15, 1931, p. 355.

Economic and administrative causes of idle time are much more spectacular and result in much greater losses than those arising from productive causes. However, productive causes are the most numerous, but these can be eliminated more easily than those arising from the other two.

Administrative causes of idle time. The most common cause of idle time resulting from administrative decision is building an addition to the existing plant of a greater capacity than is needed at the moment. Manifestly, this will result in idle time until the enterprise expands to fill this new capacity. Provided the management has taken all factors into consideration, this idle time cost may be less than the saving due to building and equipping for some period ahead. Furthermore, for most industries there is a point of production balance: there is a favorable plant unit where the various compliments of machines provide exactly the production needed. If one group of machines has either a smaller or larger capacity, a lack of balance will result. In the first case, there will result a bottleneck which will reduce the production of the entire plant; in the second case, idle time in this particular department of the plant will be unavoidable. Such lack of balance may be universal in the industry as a whole. If this is the case, then prices will normally adjust themselves to a point where recovery is made for the cost incurred. Sometimes the lack of balance is due to an effort to meet competition. For example, a small shop may put in a special machine as a service to one or two of its large customers in an effort to hold their business even though the capacity of the machine cannot be used at the time and probably will not be needed for years to come. The idle time resulting from such a purchase is, of course, the result of an administrative decision, and is not the fault of the production department. From the very nature of these causes, the administrative sources of idle time are in every case controllable in the sense that they may be avoided by administrative decision.

Production causes of idle time. Foremost among the production causes of idle time is the fact that whatever may be the theoretical engineering capacity of a given plant or machine, it is never practical to produce at that rate. It is very seldom possible to keep production flowing continuously through all machines. For example:

> If an operator is removing a quarter-inch of metal from the circumference of a steel cylinder eight inches long on an engine lathes with a spindle speed of 200 revolutions per minute, with a feed of .002 inches per revolution and with one-eighth-inch depth of cut, one part should be finished, theoretically, in twenty minutes - an output of three units per hour.[27]

This rate, obviously, anticipates perfect performance. Since cutting tools wear, and materials vary in hardness, it might take twenty-five minutes per unit.

Maze and Glover have classified idle time due to production causes as follows:[28]

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27 Canby Balderson, Robert P. Brecht, Victor S. Karabosz, and Robert J. Riddle, Management of An Enterprise (New York: Prentice-Hall, Inc., 1949), p. 62.

28 Coleman L. Maze, and John G. Glover, How to Analyze Cost (New York: The Ronald Press Company, 1929) p. 207.

1. Machine breakdown.

2. Power off.

3. Waiting for work.

    a. Lack of materials.

    b. Lack of instructions, orders, or specifications.

    c. Machine under repairs.

    d. Waiting for tools.

    e. Waiting for machine set-up man.

    f. Mistrakes in materials, tools, specifications, instructions.

    g. Waiting for an inspector.

While some machine breakdowns are unavoidable, they may be important causes of idle time, particularly where the machinery is old and has outlived its usefulness or where repairs have been unnecessarily delayed. Careless or inexperienced operators and incorrect set-ups are further causes for this type of delay.

The dependence of production upon power is obvious. If power is off, production must stop. The importance of this factor has prompted more than one company to install duplicate sources of power in order to avoid shut downs due to failure of power. Where water power is used, it is not uncommon to find auxiliary steam plants or to find connections with utilities for the power supply during dry seasons.

In some cases idle time may be due to avoidable or unavoidable lack of material or necessary tools and instructions for proceeding with the work.

In cases where work must be inspected before a new job is undertaken, waiting for an inspector may be a further cause.

Loss of time due to any of these causes may be either entirely within or without the control of factory management. On the other hand, the loss of power may be due to improper inspection of the power or the lack of materials through a failure of the stores department to order needed material when the minimum point has been reached. The power shutdown may be due to a breakdown of transmission wires; lack of materials may be due to delays in transportation or failure of a seller to meet specifications.

Economic cause of idle time. The last main group of causes of idle time is economic. A common illustration of an economic cause of idle time is the sharp variations in seasonal demand in the coal and ice, and ice cream businesses. In these businesses, unless the good can be stored with an extremely low carrying charge, it will be impossible to maintain an even rate of production. This means, of course, that at periods of low production there will be idle capacity. In some cases it is possible to supplement one business with another, and in this way avoid seasonal variations. This has been done by combining the coal and ice business and by adding ice cream to the milk business in order to take care of surplus of production during the summer months. Another illustration is the manufacture of steel toys by an automobile stamping company. If such complimentary businesses cannot be found, there will be unavoidable seasonal idle time arising from the very nature of the industry.

Cyclical fluctuations in businesses are not quite so familiar as are the seasonal variations. They are, nevertheless, an important cause of idle plant costs. It is impossible to prevent or even materially narrow these variations in production and consumption for industry. It is even more impossible for an individual business to do much more than to float along in the stream of economic forces. Some of the losses arising from cyclical fluctuations can be avoided by executive action. For example, losses arising from unused capacity may be reduced by maintaining a productive capacity less than that apparently called for at peaks of prosperity. In such a case, the extra capacity needed at the peak may be provided through overtime, night shifts, or by letting out work, thus avoiding the idle time resulting from acquiring extra capacity needed for short periods only. Avoidance of all idle time arising from cyclical causes is neither possible nor profitable. The fixed nature of plant costs will continue as an important factor causing fluctuation in unit costs under varying production. Furthermore, all attempts to interpret the results of operations must be based on a knowledge of the extent to which those results are affected by cyclical idle time.

In addition to the seasonal and cyclical types of variations which are common to most industries, there are broad changes in demand which will, at times, create a condition of overcapacity in whole industries at a given time. For example, a shifting demand from cotton to silk and rayon has been a factor in creating a chronic condition of overcapacity in the cotton industry. A number of other industries found themselves in a similar condition after the war when large capacities had been added to take care of war demands. Additional building was, in many cases, practically unavoidable, in some cases having been ordered by the government under threat of government control if the individual company did not comply. After the peak demand had passed, these companies found themselves unable to use the capacities which had been created. This type of idle time is not only unavoidable, but the costs arising from it are not recoverable, through price. It is usually not practical to liquidate or to use the equipment for other purposes. The investment is fixed and the industry as a whole must be satisfied with such return upon the investment as it can get from prices created by the forces of supply and demand. The return on such investments become largely in the nature of rents in the economic sense, since the source of supply of the product in question has become fixed.

Segregation and accumulation of idle time costs. The ultimate aim of the production manager is to eliminate idle time costs. This, of course, is impossible, so his aim then becomes directed toward placing responsibility for them. One of the greatest errors has been to lump all types of idle time costs together, thereby including both controllable production idle time in the same account. By setting up a procedure to accumulate the costs of idle time arising from the various important sources, it may be possible to take steps to reduce the sources of greatest loss.

It has been found that a periodic summarization of use of plant facilities is a valuable guide in judging the need for additional equipment or in judging whether excess idleness of facilities exist. This may be accomplished by the listing of various machines and other facilities in certain important sections during a period of normal production and comparing available hours with used hours as illustrated in figure 9.

The segregation of idleness expenses is illustrated by Alden, through the method employed by the Miller Lock Company of Philadelphia:

> The plant is departmentalized and the productive departments are further divided into machine groups consisting of machines of closely the same characteristics from a cost standpoint. Normal production of each machine group is considered to have been attained when the number of machines or process hours in the department is 80 per cent of the hours theoretically possible. In making this calculation proper allowance was of course made for special or part time machines which would not run full time under any circumstances.
>
> A chart of fixed charges was compiled by departments and machine groups, which is revised from time to time as changes occur.
>
> Each month the number of productive hours is determined from job tickets and to this is added the time of productive centers on necessary repair work to the product, and the time spent in waiting for tools, materials, etc., which is considered a legitimate part of manufacturing expense.
>
> The percentage of the hours operated to the normal hours already referred to is the measure of the degree of operation, and the difference between the percentage of operation and 100% is the percentage of idleness. This is figured separately for each machine group and the summarization of these figures gives the result of the factory as a whole.
>
> When this preliminary work has been completed, it only remains to apply the percentage of idleness against each item on the basic chart already referred to. In the case of auxiliary departments the percentage of idleness of the factory as a whole is used, but each productive machine group is figured on a basis of its own performance.

For example, assume that the press shop operated 60% of normal and the entire plant operated 75%. Then the idleness of the press shop is 40% and of the plant as a whole 25%, and if the fixed charge for supervision in the press shop is $100.00, the charge against idleness for supervision would be 40% of $100 or $40 and if, at the same time, the cost department had a fixed charge for supervision of $50, the charge for idleness in this case would be 25% of $50 or $12.50.[29]

The advantages of this method employed by the Miller Lock Company are:

1. That the amount of this expense is definitely known and the contributing factors are completely analyzed so that the management is kept in close touch with the situation and is therefore in a position to take such steps as may be necessary to bring about an improved condition.

2. By this means losses occurring from lack of operations are charged off as they occur thus avoiding the inflation of inventories.

3. Costs are automatically compensated for varying degrees of production thereby avoiding the necessity of falling back on estimated costs to obtain the same results.

4. This permits the costs obtained to reflect variations in efficiency without obscuring this by other factors entirely outside the control of the factory management.

5. Correct figures are obtained for income tax returns.

6. From a credit standpoint, banks look favorably on this method of accounting as it results in sound inventory values.

7. This system increases the effectiveness of figures given to foremen and others with the idea of helping them to increase the efficiency of their departments.[30]

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[29] William H. Alden, Jr., "Handling the Expense of Idle Facilities," The National Association of Cost Accountant's Yearbook, 1924, pp. 115-116.

[30] Ibid., p. 119

T. M. McNiece,[31] has advocated the use of an Idle Capacity Expense Account in those plants suffering from extreme variations in load. He believed that standards for expense should be set up departmentally for standard output and that the product should be charged each month with the expenses at standard rates, the difference being charged or credited to the Idle Capacity Expense Account, which amount, in turn, is charged off each month against profits. This would eliminate most of the troublesome variations in production costs that arise in variable load, and would make any variation from other causes more significant.

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[31] T. M. McNiece, "What We Have Done to Make Cost Results Effective," The National Association of Cost Accountant's Yearbook, 1927, p. 117.

FIGURE 9
ANALYSIS OF MACHINE UTILIZATION

Machine Utilization

Department____________________

Number of Machines / Type and Description Number		Total Available Production Hours per Month.	Total Normal Production Hours per Month.	Actual Production Hours per month	Idle Hours per Month
#00 B.&S. Auto Screw Machine	16	Number of Machine times 40 hours times number of working days in month.	Total available Production Hours less "down" time for set-up, repairs, and normal maintenance.	Actual Working time of machine for the month.	Actual hours less normal production hours.
#2 B.&S. Auto Screw Machine	5				

A. The aforegoing serves to estop purchase of new equipment when existing facilities are not being used to normal extent.

B. It stimulates inquiry as to cause of idleness. This may be due to excessive breakdowns, caused by age, or by improper maintenance.

C. It may permit of disposition of excess facilities, thus reducing fixed charges and increasing cash balance.

Source: E. E. Lewis, "Expenditures and Investments," The National Association of Cost Accountant's Bulletin, 22:285, November 15, 1940.

CHAPTER V

CONCLUSIONS

In the previous chapters, views of different accountants have been presented concerning plant capacity costs. No definite recommendations have been made in those chapters. Instead, the reader has been left to draw his own conclusion regarding the subject matter.

Except in terms of generality, many of the statements presented in the preceding chapters could be proven untrue. For instance, there may be times when management would desire to bear the idle plant expense, rather than those incurred in marketing a greater amount of the product. In the construction of a new plant, management may decide to build one large enough to take care of the anticipated needs in future years, knowing that in the first few years only one-half the plant would be utilized. In such a case there might well be a savings realized by combining the construction and bearing the idle plant expense. As such, the idle capacity cost would seem to be another expense rather than an added cost of making the product. Acknowledging the fact that several exceptions can be taken, looking at the subject matter from the factory manager's viewpoint, the paragraphs that follow will present this writer's opinion.

Normal capacity. It appears that there can be no doubt that actual costs are not the best measure of true costs, that the proper amount of burden to be charged to a product is the amount incurred at normal production. Normal capacity tends to eliminate fluctuations in cost due to volume factor. Normal capacity automatically establishes sound cost estimates which enable industry to establish and maintain a sound price structure. The main purposes of normal capacity are to help establish standard costs for price-making, to aid in planning sales and production, to determine the profit-realization point, to help provide plant balance, and assist in the allotment of volume. There are two bases upon which normal capacity can be determined. In this writer's opinion, normal capacity should be based upon sales expectancy, which is the utilization of the plant facilities to meet expected sales over a period of years.

Normal burden rates. There is also little doubt in the mind of the writer that normal capacity should be the basis for burden accounting. This is especially true in industries that are subject to sharp variations in seasonal demand. If overhead rates are computed separately for each month in these seasonal industries, unreliable costs will result. Also, in many instances a more reliable cost picture is obtained when separate rates for fixed and variable overhead are employed. Fixed expenses of any service department are dependent on its capacity to serve, but this capacity to serve is related to the capacities of producing departments to operate. Therefore, the fixed expenses should be distributed in the ratio of capacities. Variable expenses, on the other hand, are directly related to activity and should be distributed on that basis. As to the method to use to dispose of overhead variances, the most conservative, and most logical, is to adjust the cost of sales and inventory on a pro-rata basis.

Idle time and capacity. Smaller profits are due primarily to low production. Idle time and capacity costs are pervasive; they are always present and are not foreign to any industry. There are three main causes of idle time: administrative, production, and economic. Production causes are the most numerous, but these can be eliminated more easily than those arising from the other two. The utlimate aim of the production manager is to eliminate idle time costs. Since this is impossible, his secondary aim is to place responsibility for them. One of the greatest errors has been to lump all types of idle time costs together, thereby including both controllable production idle time with noncontrollable economic idle time in the same account. By setting up a procedure to accumulate the costs of idle time arising from the various important sources, it may be possible to take steps to reduce the sources of greatest loss.

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