CHAPTER 8

PRODUCTION: CAPACITY CHANGES

Your management team will need to make an early decision regarding expansion of production capacity. All of the plants in your industry world have been operating fairly close to capacity. Sales in the industry have been increasing at a rate that soon will require additional facilities if the demand for your product is to be met. Questions that need to be answered before making an investment decision include:

1. "How much additional productive capacity will be required?"

2. "Which, if any, of the expansion options should our firm undertake?"

Your estimate of production requirements (see Chapter 7) should assist you in answering the first question. The answer should be to expand capacity enough to meet expected sales demand as long as the expansion contributes toward meeting the goals of your firm and contributes to its profitability. An answer to the second question requires an evaluation of the expansion options discussed in this chapter, a comparison of their costs and the time required to implement them. In addition, there must be sufficient cash available to finance the investments that your firm decides to undertake. Various investment options are described below in the order of the time required for their implementation.

In an inflationary economy, one expects prices generally to follow the level of price changes in the economy of a country. All construction, hiring and training costs outlined in this chapter are those in effect at the beginning of Year 3, as you assume management of the company. The costs in effect for subsequent quarters may be estimated by adjusting the Year 3, Quarter 1 costs using the Consumer Price Index (CPI) of the country for the most recent quarter prior to the one in which the expenditures will occur (prices are set based upon the previous quarter's cost of living reports). **All construction contracts include a provision for cost increases due to inflation** over the period of construction.

Investment Options

Overtime

Working your production crews overtime is the fastest way to expand production. Furthermore, it is the only way in which production can be expanded without a delay of at least one quarter. By scheduling overtime, it is possible to increase output by about 20 percent over the normal forty-hour week production level. Restrictions in the union contract make it impossible to schedule production for less than **forty hours** or for more than **forty-eight** hours per week.

Units produced while crews are working overtime are somewhat more expensive than those manufactured during the normal workweek. In Merica, production employees are paid time-and-a-half for overtime work. Unit labor costs thus are 50 percent more for goods produced when production lines are running overtime. To comply with host country laws, production employees in Sereno are paid double time resulting in a doubling of labor costs for overtime work. These extra labor costs are partially offset by depreciation charges being spread over a larger number of units of production. Overtime costs are described in Chapter 7.

Second Shift

A second shift of workers may be scheduled for existing first-shift production lines in your **home-area plant**. This will enable you to double production without any additional investment in plant facilities or equipment. Second-shift workers receive a 10 percent premium wage for working nights.

At the beginning of Year 3, it costs $100,000 and requires one quarter to hire and train workers to operate a second shift on a home-area production line. If you wish to schedule production for a second shift on one or more of your existing lines in Year 3, Quarter 2, you **must**, in Quarter 1, enter the number of lines desired under New Lines–2nd Shift on the decision form. During the first quarter of Year 3, workers will be hired and trained, with the costs appearing as Training Costs on your firm's Income Statement. The second shift will be available to begin production on the line(s) during the second quarter of Year 3. At that time it must be scheduled for production, idled with a temporary layoff or deactivated (See Chapter 7). A second shift may be added to all producing lines in the home-area plant. There is no provision in the model for second-shift operations in other plants.

To add second-shift lines, enter the number of lines on the decision form under New Lines–2nd Shift. The line(s) will be available for production during the **following** quarter.

Limits: 0 to number of 1st shift lines operating in home area

Additional Production Lines

The existing plant in your home area was built to house eight production lines. To date, only six lines have been built. Thus, there is space for two additional lines as indicated in the Operating Information Report (see Appendix C).

	Area 1	Area 2	Area 3	Sereno
Space Available for New Lines	2	0	0	0

New production lines have the same operating characteristics, costs and output capabilities as existing lines. **One quarter** is required to install the necessary equipment and to hire and train workers for new production lines. In order to have additional lines available for production during the third quarter of Year 3, it would be necessary to begin construction of those lines in Quarter 2.

A capital expenditure of $500,000 (or Ps 3,000,000 in Sereno) is required to purchase new equipment for each line that is added. In addition, it costs $100,000 (Ps 600,000) to hire and train new employees to work on each new production line. The capital expenditure and hiring and training costs are incurred during the quarter of construction. Your Cash Flow Analysis statement will show an expenditure for equipment of $500,000 (Ps 3,000,000) per line, and the Income Statement will show a training expense of $100,000 (Ps 600,000) per line, to cover hiring and training costs. These costs are subject to inflation.

Equipment is depreciated on a straight-line basis over seven years, with no salvage value. Quarterly depreciation charges equal 1/28th (3.5714 percent) of the original cost. New equipment expenditures are capitalized during the quarter in which the line(s) are constructed and depreciation charges also are levied. Thus, an expenditure of $500,000 for equipment for one line would increase equipment depreciation charges for the quarter by about $18,000.

$$0.035714 \times \$500,000 = \$17,857$$

The only limitation on the number of lines which can be under construction at one time is the availability of space in the plant. Your firm could increase its production capacity by one-third as early as Quarter 2 of Year 3 by adding lines 7 and 8 to your existing plant during Quarter 1. While operating costs of new lines are the same as for existing lines, unit production costs will be somewhat lower because plant depreciation charges will be spread over the larger number of units produced in the plant during the quarter.

To begin construction and train workers, enter the number of new lines to be added on the decision form. The entry should be made in the market area where a plant with additional space is located. After the construction has begun, no further entry is necessary until the lines are ready and available for production. Entries in subsequent quarters will result in starting **additional** new lines at that time (if space is available; otherwise the entries will be rejected by the decision-entry

program). When ready for production, and not before, new lines must be scheduled for production, idled or deactivated.

Limits: 0 to number of lines for which space is available

	Sales Office Orders	Construction		
	(000s)	New Lines	New Add'n	New Plant
Area 1	# 87	#	#	#
Area 2	# 75	#	#	#
Area 3	# 75	#	#	#
Sereno	# 75	#	#	#
2nd Shift		#	← ← ← ←	

Addition to Existing Plant

When the plant in your home area was built, sufficient land was reserved to permit the building of an addition on each of two sides of the plant. Each addition will provide space for two production lines and each represents an increase of 25 percent of the presently available space for production capacity. Your existing plant shell has room for eight lines. Adding two more will give you space to install a total of ten lines. **Two quarters** are required to complete construction of a new addition.

The installation of production lines in the addition may be started during the second quarter of addition construction so that the lines will be available for production as soon as the plant addition is completed. Construction may begin on only **one two-line addition** for any plant during any quarter. If desired, however, construction may be started on another addition in a subsequent quarter while the first is still under construction, provided that such construction will not cause the maximum plant capacity of twelve lines to be exceeded.

At the beginning of Year 3, construction of a new addition requires a capital expenditure of $900,000 (Ps 5,400,000), which must be paid to the contractor in two installments over the construction period. Construction contracts contain a provision for increasing installment payments by the rate of inflation during the contract period. Your Cash Flow Analysis Statement will show a capital expenditure of $450,000 (Ps 2,700,000) or more (remember inflation) during each quarter of construction. These amounts will be capitalized and depreciated at the same rate as the existing plant. Depreciation is on a straight-line basis over 31.5 years, with no salvage value. Quarterly depreciation charges amount to 0.7937 percent of the **original cost** of all construction

in place at the end of each quarter. After completion, construction of one new two-line addition will cause depreciation charges to be increased by at least $7,143 (Ps 42,860) per quarter:

$900,000 x .007937 = $7,143

To begin construction, enter "2"—the number of lines of capacity—under Construction–New Add'n on the decision form in the marketing area in which you wish to construct the new addition. After construction has begun, no further entries are necessary except to begin construction of the production lines so that the lines will be available for production when desired. New-line construction may be started during the second quarter of construction of the new addition, or any time thereafter.

Limits: 0 **or** 2 lines (to a maximum capacity of 12 lines)

Construction of a New Plant

The final option for expanding production capacity is to construct a new plant in another market area. Your company may locate a plant in any area you desire, provided that you do not already have a plant in that area. You may move into a competitor's home area or into Sereno. Plant construction requires **three quarters** to complete. A plant may be built with a capacity of either two, four, six, eight or ten lines. Additions may be built later to increase plant size to a maximum capacity of twelve lines. Construction costs for each plant size are shown below. Costs are those in effect at the beginning of Year 3, and are subject to inflationary changes. Depreciation is on a straight-line basis over 31.5 years, with no salvage value. Quarterly depreciation charges are calculated as 0.7937 percent of the original cost.

	--------Merica--------		----------Sereno----------	
Capacity	Cost	Quarterly	Cost	Quarterly
2 lines	$1,200,000	$400,000	Ps 7,200,000	Ps 2,400,000
4 lines	1,900,000	633,333	11,400,000	3,800,000
6 lines	2,600,000	866,666	15,600,000	5,200,000
8 lines	3,300,000	1,100,000	19,800,000	6,600,000
10 lines	4,000,000	1,333,333	24,000,000	8,000,000

Local governments in all of the market areas would like your firm to build a plant in their area to stimulate job growth. Sereno further requires your firm to reinvest 50 percent of net profits until a reserve equal to 50% of capital stock has been accumulated to encourage local investment. Likewise, Merica areas strongly encourage local investment to stimulate job growth. Local tax breaks and other benefits often are offered to attract a new plant.

Construction costs must be paid to the contractor in three installments during the construction period. Construction contracts contain a provision for increasing installment payments by the rate of inflation during the contract period. If an eight-line plant is being built, your Cash Flow Analysis will show a capital expenditure of at least $1,100,000 (Ps 6,600,000) during each quarter of construction, with the total expenditure amounting to $3,300,000 (Ps 19,800,000) or

more. Construction payments are capitalized and subject to depreciation during the quarter in which they are paid.

Building a plant shell, by itself, will not permit you to produce any goods. In order for production to begin, **production lines** must be installed at a cost of at least $600,000 (Ps 3,600,000) each, including hiring and training costs for new workers. If you plan to schedule production as soon as the plant is finished, you **must** begin installation of production lines during the third quarter of plant construction. The plant and new lines will be installed and workers trained during that quarter. Any number of lines up to the full capacity of the plant may be installed. Space availability for new lines will be reported in the Operating Information Report as soon as construction may begin.

Operating costs and production capabilities for a new plant will be the same as those for the existing plant in your home area. Second-shift operations, however, are not feasible in non-home areas because of a shortage of supervisory personnel.

Your firm will realize transportation cost savings after completing a new manufacturing plant. A sales office that is located in an area with a plant stores its inventory within a partitioned area of the plant warehouse. Thus, no costs are incurred for shipments to the sales office in the area. Transportation costs for sales in that area only are due for shipments from the plant to customers in the same area at a rate of 10 cents (60 centavos) per unit. This results in a savings of 60 cents per unit for shipments to a domestic sales office and 90 cents per unit for shipments to Sereno. See Chapter 5 for information on transportation expenses.

To begin construction of a new plant, enter the number of lines of capacity that are desired (2, 4, 6, 8 or 10) in the market area in which the new plant is to be located. After construction has begun, no further entry is required except to begin construction of new lines prior to the start of production.

Limits: 0 in home area; 0, 2, 4, 6, 8 or 10 lines in other areas

Closing a Plant

If your firm has overbuilt its productive capacity, it may decide to close one of its plants. You may close a plant in any area by entering a negative value of one (-1) under plant construction for the area on the decision form. At the same time you must deactivate all production lines. All employees, including plant executives, will automatically be discharged. The plant will be sold at 90 percent of book value to a local developer. The book value includes any new additions which may have been built or still are under construction.

After deactivation, the equipment in the plant will be sold to an equipment supplier at 90 percent of book value. Both the developer and the equipment supplier will make payment during the quarter in which the plant is closed, so the proceeds can be used to meet expenses during the quarter.

Summary

Investment Options

1. **Overtime work** to 48 hours a week may increase production by about 20 percent. Labor costs for working more than 40 hours per week are 50 percent higher than normal in Merica and 100 percent higher in Sereno. Fixed costs are spread over more units. There is no delay in implementation.

2. A **second shift** may be added to lines in your home-area plant. Labor costs are 10 percent higher. There is a one-quarter delay while workers are hired and trained at a cost of $100,000. Second-shift production lines may be idled or deactivated the same as first shift lines.

3. **Additional production lines** may be added, space permitting, at a cost of $500,000 (Ps 3,000,000) each. Hiring and training of new workers costs $100,000 (Ps 600,000) per line. Construction requires one quarter. All costs of construction, hiring and training ($600,000 or Ps 3,600,000) are charged during the quarter of construction.

4. **Additions to existing plants** may be made so long as the maximum plant size of twelve lines capacity is not exceeded. Each addition has capacity for two production lines and costs $900,000 (Ps 5,400,000). Construction requires two quarters and costs are charged at the rate of $450,000 (Ps 2,700,000) per quarter, subject to inflation.

5. A **new plant** may be constructed in any marketing area where your company does not already have a plant. Construction requires three quarters to complete and one-third of the total cost must be paid during each quarter of construction, subject to inflation. Total and quarterly costs are:

	--------Merica--------		----------Sereno----------	
Capacity	Cost	Quarterly	Cost	Quarterly
2 lines	$1,200,000	$400,000	Ps 7,200,000	Ps 2,400,000
4 lines	1,900,000	633,333	11,400,000	3,800,000
6 lines	2,600,000	866,666	15,600,000	5,200,000
8 lines	3,300,000	1,100,000	19,800,000	6,600,000
10 lines	4,000,000	1,333,333	24,000,000	8,000,000

6. **Closing a plant**. An existing plant may be closed. If closed, all lines must be deactivated. Employees will be discharged. The plant and its equipment will be sold for 90 percent of book value.

7. **Training costs**, per line (subject to inflation):

for newly constructed lines:	$100,000 or Ps 600,000
for new second-shift lines:	$100,000 (home area only)
for reactivated 1st and 2nd-shift lines:	$50,000 or Ps 300,000

All costs shown are those in effect at the beginning of Year 3 and are subject to local inflationary increases in proportion to changes in the Consumer Price Index.

Plant Closure

Closing a plant involves shutting down operations, deactivating all lines and selling the building and equipment. Both the building and equipment are sold for 90 percent of book value. Proceeds of the sale are received during the quarter of sale.