Chapter 16

Estimating Cash Flows

16-1
A small community outside of Atlanta Georgia is planning to construct a new fire station. As currently planned it will have 7,000 square-feet under roof. The area cost factor is 86% of the 144-city average. The estimated cost per square foot for a typical 3,500 square facility is $98. Based on economies of scale a size adjustment factor of 95% can be used. Estimate the cost of the construction. Assume a cost growth factor of 1.364.

Solution

Estimated cost = 98(7,000)(.95)(.86)(1.364)
= $764,470

16-2
In 2000 a new 21-kW power substation was built in Gibson county Tennessee for 1.4 million dollars. Weakley county, a neighboring county, is planning on building a similar though smaller substation in 2003. An 18-kW substation is planned for Weakley county. The inflation rate between 2001 and 2003 has averaged 1.5% per year. If the capacity exponent is .85 for this type of facility what is the estimated cost of construction?

Solution

Cost of the 21-kW substation in 2003 dollars = 1,400,000(1.015)^3 = $1,463,950

\[ C_2 = C_1(S_x/S_k)^n \]

\[ C_{21} = C_{18}(18/21)^{.85} = 1,463,950(.8772) = 1,284,177 \]

16-3
The time required to produce the first gizmo is 1500 blips. Determine the time required to produce the 450th gizmo if the learning-curve coefficient is .85.

Solution

\[ T_i = T_1\Theta_i^{(\ln i/\ln 2)} \]

\[ T_{450} = 1500(.85)^{(\ln 450/\ln 2)} = 358.1 \text{ blips} \]

16-4
Chapter 16 Estimating Cash Flows

Four operations are required to produce a certain product produced by ABC Manufacturing. Using information presented in the table below, determine the labor cost of producing the 1000 piece.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Time required for 1st piece</th>
<th>Learning curve coefficient</th>
<th>Labor cost per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation 1</td>
<td>1 hour 15 minutes</td>
<td>.90</td>
<td>$ 8.50</td>
</tr>
<tr>
<td>Operation 2</td>
<td>2 hours</td>
<td>.82</td>
<td>12.00</td>
</tr>
<tr>
<td>Operation 3</td>
<td>2 hours 45 minutes</td>
<td>.98</td>
<td>7.75</td>
</tr>
<tr>
<td>Operation 4</td>
<td>4 hours 10 minutes</td>
<td>.74</td>
<td>10.50</td>
</tr>
</tbody>
</table>

**Solution**

\[ T_i = T_1 \theta \left( \frac{\ln i}{\ln 2} \right) \]

Operation 1

\[ T_{1000} = T_1(0.90) \left( \frac{\ln 1000}{\ln 2} \right) = 26.25 \text{ minutes} \]

Cost = \( \frac{26.25}{60} \times 8.50 = $3.72 \)

Operation 2

\[ T_{1000} = T_1(0.82) \left( \frac{\ln 1000}{\ln 2} \right) = 16.61 \text{ minutes} \]

Cost = \( \frac{16.61}{60} \times 12.00 = $3.32 \)

Operation 3

\[ T_{1000} = T_1(0.98) \left( \frac{\ln 1000}{\ln 2} \right) = 134.91 \text{ minutes} \]

Cost = \( \frac{134.91}{60} \times 7.75 = $17.43 \)

Operation 4

\[ T_{1000} = T_1(0.74) \left( \frac{\ln 1000}{\ln 2} \right) = 12.44 \text{ minutes} \]

Cost = \( \frac{12.44}{60} \times 10.50 = $2.18 \)

Total cost = $3.72 + $3.32 + $17.43 + $2.18 = $26.65

Turbo Tire has developed a new tire that it believes will be very competitive in the market place. It expects that the tire will be a solid seller for the next several years. The marketing department estimates that the upper limit in the demand will be 800,000 tires. Initially the tires will be sold for $56.00 each and after 2 years the price will increase by $8.00 each year until the price reaches
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$80.00. The cost of production for each tire is estimated to be $32.00 the first year and will increase by $4.00 each year. Assume that a Pearl curve with \( a = 6,000 \) and \( b = 4 \) applies. What will be the expected demand for the next 5 years? What are the expected revenues (gross and net) for the same period?

Solution

\[
D = \frac{L}{1 + ae^{bt}} = \frac{800,000}{1 + 6,000e^{4t}}
\]

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand</td>
<td>7,214</td>
<td>265,536</td>
<td>771,556</td>
<td>799,460</td>
<td>799,990</td>
</tr>
<tr>
<td>Revenue</td>
<td>$403,984</td>
<td>$14,870,016</td>
<td>$49,379,584</td>
<td>$57,561,120</td>
<td>$63,999,200</td>
</tr>
<tr>
<td>Cost</td>
<td>$230,848</td>
<td>$9,562,896</td>
<td>$30,862,240</td>
<td>$35,176,240</td>
<td>$38,399,520</td>
</tr>
<tr>
<td>Net Revenue</td>
<td>$173,136</td>
<td>$5,307,120</td>
<td>$18,517,344</td>
<td>$22,384,880</td>
<td>$25,599,680</td>
</tr>
</tbody>
</table>

16-6

American Petroleum (AP) recently completed construction on a large refinery in Texas. The final construction cost was $17,500,000. The refinery covers a total of 340 acres. The Expansion and Acquisition Department at AP is currently working on plans for a new refinery for the panhandle of Oklahoma. The anticipated size is approximately 260 acres. If the capacity exponent is .67 for this type of facility what is the estimated cost of construction?

Solution

\[
C_x = C_k \left(\frac{S_x}{S_k}\right)^n
\]

\[
C_{260} = C_{340} \left(\frac{260}{340}\right)^{0.67} = 17,500,000 \times 0.83549 = 14,621,075
\]

16-7

A new training program at Arid Industries is intended to lower the learning curve coefficient of a certain molding operation that currently costs $95.50/hour. The current coefficient is .87 and the program hopes to lower the coefficient by 10%. Assuming the time to mold the first product is 8 hours. What cost savings can be realized when the 2000th piece is produced if the program is successful?

Solution

\[
T_i = T_1 \Theta^{\left(\ln i / \ln 2\right)}
\]

Without the training program:

\[
T_{2000} = 8 \times 0.87^{\left(\ln 2000 / \ln 2\right)} = 1.74 \text{ hours}
\]

With the training program:
\[ T_{2000} = 8(0.783)^{\ln 2000 / \ln 2} = 0.547 \text{ hours} \]

\[
\text{Cost savings} = (1.74 - 0.547)(95.50) = $113.93
\]

16-8
The following data is has been provided by XYZ Manufacturing concerning one of their most popular products. Estimate the selling price per unit.

- Labor = 12.8 hours at $18.75/hour
- Factory overhead = 92% of labor
- Material costs = $65.10
- Packing cost = 10% of materials
- Sales commission = 10% of selling price
- Profit = 22% of selling price

Solution

\[
\begin{align*}
\text{Labor Cost} &= 12.8 \times 18.75 = $240.00 \\
\text{Factory overhead} &= 92\% \text{ of labor} = 220.80 \\
\text{Material cost} &= = 65.10 \\
\text{Packing Cost} &= 10\% \text{ of material costs} = 6.51 \\
\text{Total} &= $532.41
\end{align*}
\]

Let \( X \) be the selling price

\[
0.10X + 0.22X + 532.41 = X \\
0.68X = 532.41 \\
X = 532.41 / 0.68 = $782.96
\]