



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Project Management for Managers

Lec – 54 Cost Estimation

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Cost management is extremely important for running successful projects. The management of costs, in many ways, reflects the project origination's strategic goals, mission statement, and business plan.



Some of the common sources of costs

Labor

Material

Subcontractors

Equipment and facilities

Travel



Common classification of costs

Direct and indirect (overhead costs; depreciation, health and retirements benefits, selling and general administrative expenses)

Recurring (labor, logistic, material, etc.) **and non recurring** (charges applied **once** at the beginning or end of project)

Fixed (when leasing capital equipment or other project hardware, the leasing price is likely **not to go up or down** with the amount of uses) **and Variable** (Metal cutting operation)

Normal and expedited



Costs	Type		Frequency		Adjustment		Schedule	
	Direct	Indirect	Recurring	Non-recurring	Fixed	Variable	Normal	Expedited
Direct labor								
Building lease								
Expedite costs								
Material								



Costs	Type		Frequency		Adjustment		Schedule	
	Direct	Indirect	Recurring	Non-recurring	Fixed	Variable	Normal	Expedited
Direct labor	x		x		x		x	
Building lease		x	x		x		x	
Expedite costs	x			x		x		x
Material	x		x			x	x	



Learning Curves in Cost Estimation

Let us assume, for example, that the time necessary to code a **particular software routine is estimated at 20 Hrs** of work for the first iteration. Doing the coding work a **second time requires only 15 hrs**. The **learning ratio** is $15/20 = 75\%$. We can now apply that figure to estimates of cost for additional coding iterations.

When the output is doubled from the first two routines to the required four, the time needed to complete the exercise is now estimated to take

$$15 * 0.75 = 11.25 \text{ hrs.}$$



Learning curves in cost estimation

These **time and cost estimates** follow a well defined formula, which is the time required to produce a unit of output, and is represented as:

$$Y_x = a (X)^b$$

Where

Y_x = Time required for x unit of output

a = the time required for the initial unit of output

X = the number of units to be produced

b = the slope of the learning curve, represented as: **log decimal learning rate / log 2**

Example: Worker must do 15 of these activities (fitting, riveting, and squaring). Also assume that the time estimated to perform the last iteration (steady state) is 1 hr., and we know from past experience the learning rate of this activity is 0.60.

In calculation the time necessary to complete the first activity , we would apply the above values to the formula to determine the value of “a”,.....



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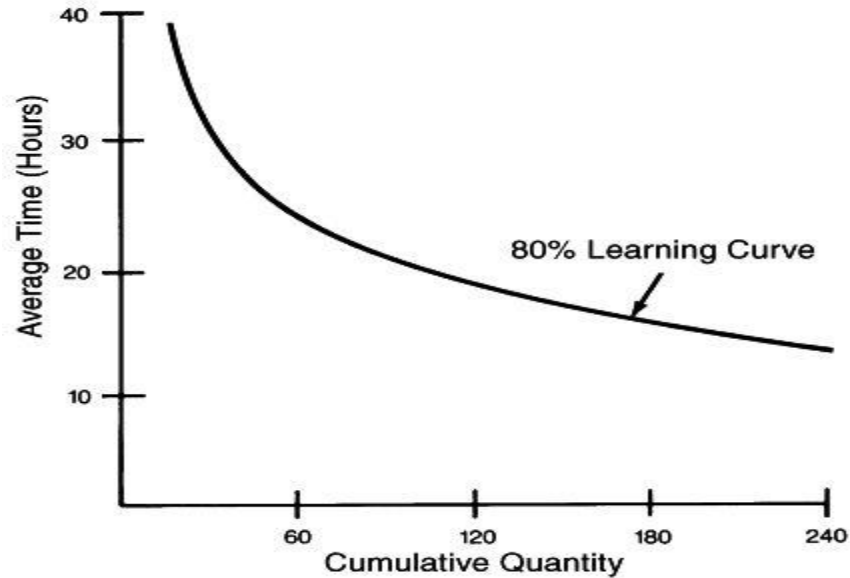
In calculation the time necessary to complete the first activity , we would apply the above values to the formula to determine the value of “a”,.

$$\begin{aligned} b &= \log 0.60 / \log 2 \\ &= -0.5108 / 0.693 \\ &= -0.737 \end{aligned}$$

$$\begin{aligned} 1 \text{ hr} &= a(15)^{-0.737} \\ a &= 7.358 \text{ hrs.} \end{aligned}$$



Learning curves in cost estimation: As can be seen, as production quantities double, the average time per unit decreases by 20% of its immediate previous time.



Sample project budget

Activity	DC	Budget overhead	Total cost
Survey	3500	500	4000
Design	7000	1000	8000
Clear site	3500	500	4000
Foundation	6750	750	7500
Framing	8000	2000	10000
Plumb and wire	3750	1250	5000



Sample budget tacking planned and actual activity costs.

	Budget		
Activity	Planned	Actual	variance
Survey	4000	4250	250
Design	8000	8000	0
Clear site	4000	3500	-500
Foundation	7500	8500	1000
Framing	10000	11250	1250
Plumb and wire	5000	5150	150
Total	38500	40650	2150



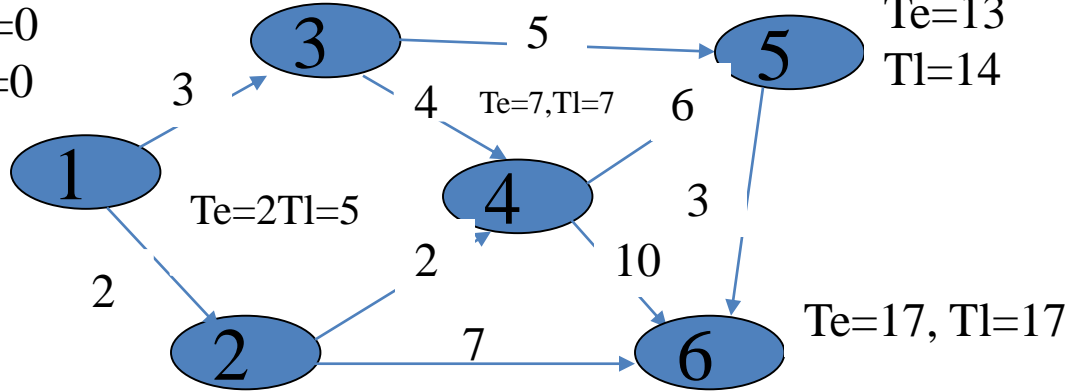
Example of time phased budget

Activity	Month					Total activity by
	Jan	Feb	March	April	May	
Survey	4000					4000
Design		5000	3000			8000
Clear site		4000				4000
Foundation			7500			7500
Framing				8000	2000	10000
Plumb and wire				1000	4000	5000
Monthly planned	4000	9000	10500	9000	6000	
Cumulative	4000	13000	23500	32500	38500	38500



Te=3 Tl=3

Te=0
Tl=0



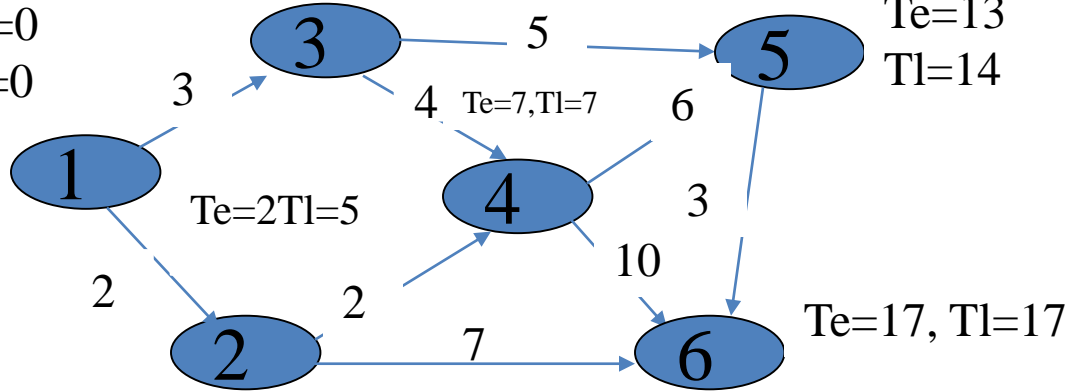
Find cumulative cost by considering earliest start solution.

Activity	Duration (months)	ES _{ij}	LS _{ij}	Total cost (Rs 100)	Cost per month
1-2	2	0	3	1200	600
1-3	3	0	0	900	300
2-4	2	2	5	0	0
2-6	7	2	10	2800	400
3-4	5	3	3	2000	400
3-5	5	3	9	2000	400
4-5	6	7	8	3000	500
4-6	10	7	7	8000	800
5-6	3	13	14	2100	700

Day	1-2	1-3	2-4	2-6	3-4	3-5	4-5	4-6	5-6	Cum Cost
1	600	300								900
2	600	300								1800
3		300	0	400						2500
4			0	400	500	400				3800
5				400	500	400				5100
6				400	500	400				6400
7				400	500	400				7700
8				400		400	500	800		9800
9				400			500	800		11500
10							500	800		12800
11							500	800		14100
12							500	800		15400
13							500	800		16700
14								800	700	18200
15								800	700	19700
16								800	700	21200
17								800		22000

$Te=3, Tl=3$

$Te=0$
 $Tl=0$



Find cumulative cost by considering latest start solution.

Activity	Duration	Esij	LSij	Total cost (Rs 100)	Cost per month
1-2	2	0	3	1200	600
1-3	3	0	0	900	300
2-4	2	2	5	0	0
2-6	7	2	10	2800	400
3-4	5	3	3	2000	400
3-5	5	3	9	2000	400
4-5	6	7	8	3000	500
4-6	10	7	7	8000	800
5-6	3	13	14	2100	700

Day	1-2	1-3	2-4	2-6	3-4	3-5	4-5	4-6	5-6	Cum Cost
1		300								300
2		300								600
3		300								900
4	600				500					2000
5	600				500					3100
6			0		500					3600
7			0		500					4100
8								800		4900
9							500	800		6200
10						400	500	800		7900
11				400		400	500	800		10000
12				400		400	500	800		12100
13				400		400	500	800		14200
14				400		400	500	800		16300
15				400				800	700	18200
16				400				800	700	20100
17				400				800	700	22000

Te	Tl
900	300
1800	600
2500	900
3800	2000
5100	3100
6400	3600
7700	4100
9800	4900
11500	6200
12800	7900
14100	10000
15400	12100
16700	14200
18200	16300
19700	18200
21200	20100
22000	22000

