

Project Resources and Time Management

PMG 605

Lecture 8

Project Budget

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Lecture

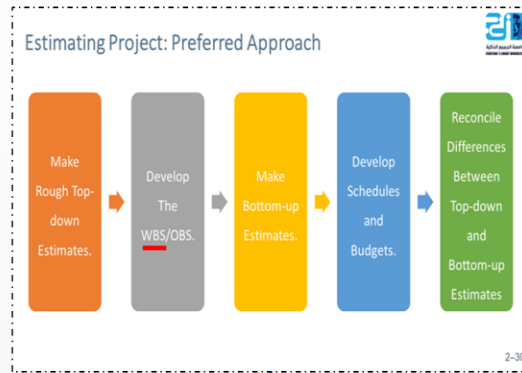
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Session Outline

Project Budget

- Project Cost Accounting Systems
- Elements Of Budgets And Estimates
- Creating a Time-Phased Budget
- Budget Contingencies
- Why a Time-Phased Budget Baseline Is Needed

Estimating Process Output



Required **Time** fore each Task
(Work Package / Activity)

Required **Resources** fore each
Task (Work Package / Activity)

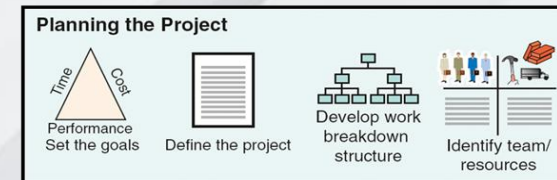
Required **Cost** fore each Task
(Work Package / Activity)

Project Scheduling
Project Schedule Baseline

Resources Planning

Project Budget
Project Cost Baseline

Project Planning, Scheduling, and Controlling of Investments

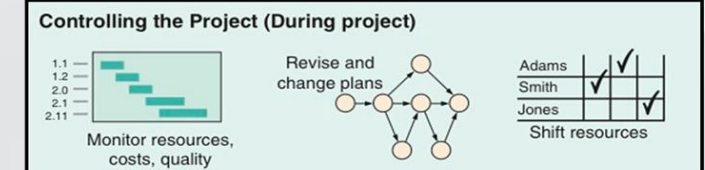


Time/cost estimates
Budgets
Engineering diagrams
Cash flow charts
Material availability details



Budgets
Delayed activities report
Slack activities report

CPM/PERT
Gantt charts
Milestone charts
Cash flow schedules



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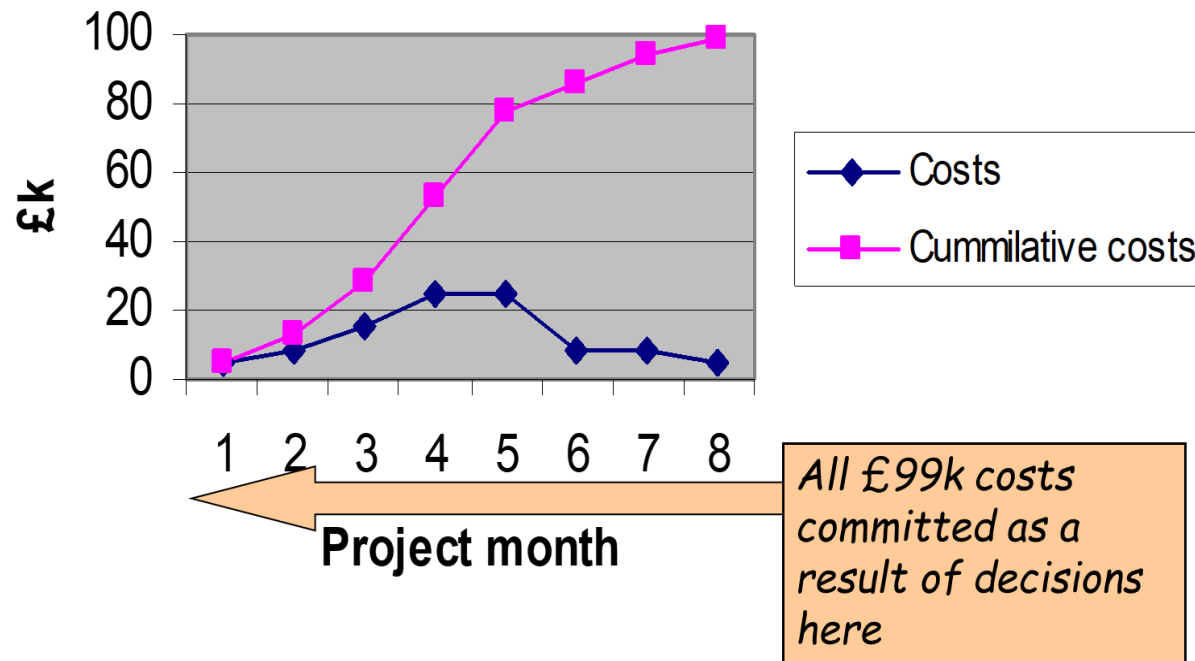
Project Budget

Project network times are not a schedule until resources have been assigned.

Cost estimates are not a budget until they have been time-phased.

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Project Budget



	Cost	Month incurred
Market research	£5k	1
Concept designs	£8k	2
Detail designs	£15k	3
Prototype parts	£25k	4
Assembly	£10k	5
Initial test	£8k	5
Rectification	£7k	5
Beta test	£8k	6
Documentation	£8k	7
Launch	£5k	8

PROJECT COST ACCOUNTING SYSTEMS

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Project Cost Accounting Systems (PCAS)

- A project is a system of sometimes hundreds or thousands of elements—workers, materials, and facilities—all which must be estimated, budgeted, and controlled.
- To expedite the process, reduce confusion, and improve accuracy, you need another system; in particular, one to help compute estimates, create, store and process budgets, and track costs.
- Such a system, called a project cost accounting system (PCAS), is initially set up by the project manager, project accountant or Project Management Office (PMO).

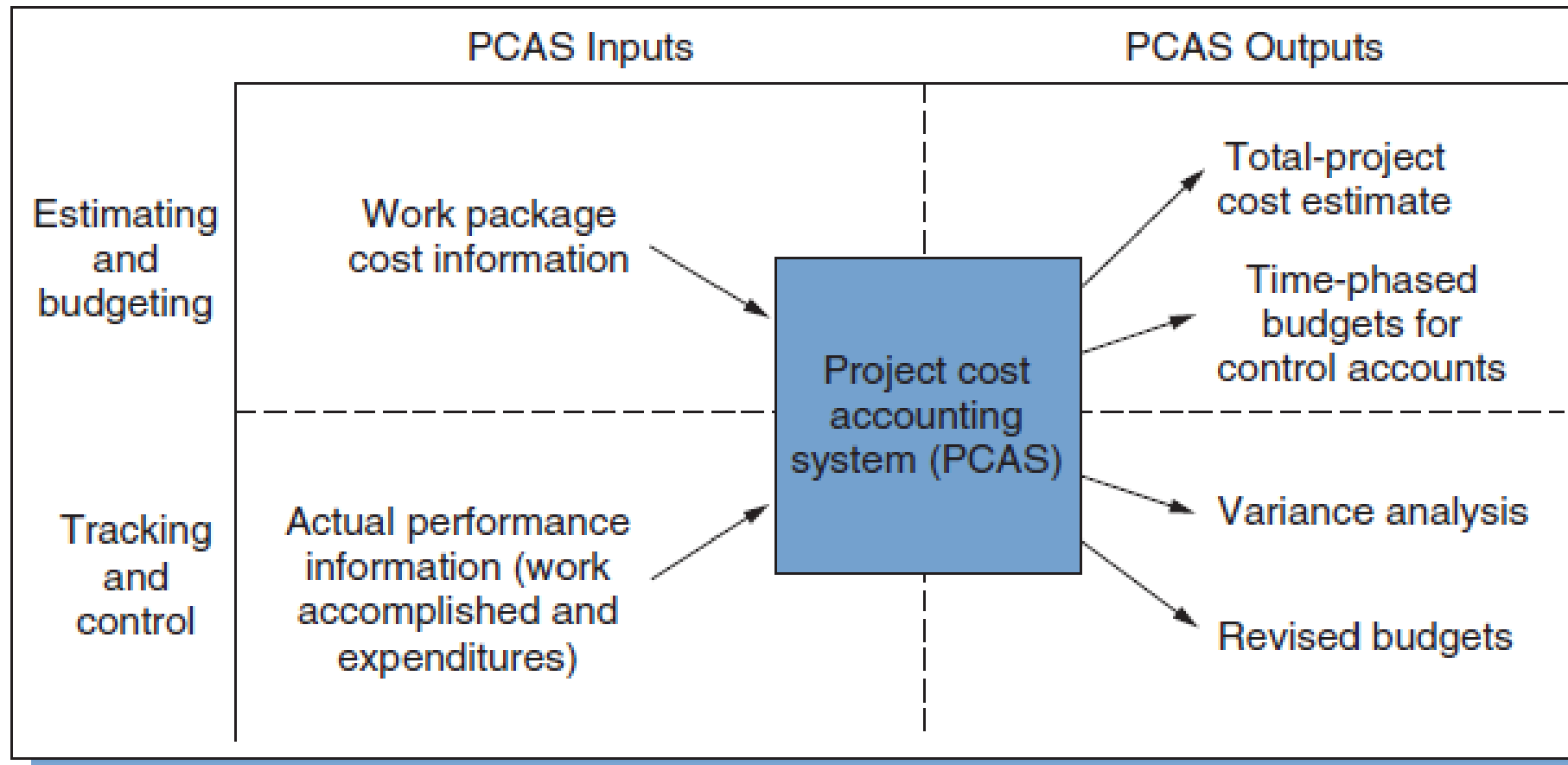
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Project Cost Accounting Systems (PCAS)

- While the main focus of the PCAS is on project costs, the system also assists tracking and controlling schedules and work progress.
- When a PCAS is combined with other project planning, control, and reporting functions, the whole system is referred to as the project management information system (PMIS).

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Project Cost Accounting Systems (PCAS)



Elements Of Budgets And Estimates

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Elements Of Budgets And Estimates

- Budgets and cost estimates are the same in that both state the cost of doing something.
- The difference is that the estimate comes first and is the basis for the budget.
- An ***estimate*** may have to be refined many times, but once approved it becomes the ***budget***.

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Elements Of Budgets And Estimates

- Organizations and work units are then committed to performing work according to the budget.
- It is the agreed upon amount for what the work should cost, and the baseline against which actual expenditures will be compared.
- Project budgets and fiscal operating budgets are similar; the difference is that the former covers the life of a project, the latter only a year at a time.

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Elements Of Budgets And Estimates

- Estimates and budgets share the following elements:
 - Direct Labor Expense
 - Direct Non-Labor Expense
 - Overhead Expense (Direct Overhead)
 - General and Administrative Expense (Indirect Overhead)
 - Profit and total billing

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Direct Labor Expense

- Direct labor expense is the labor charges applied directly to the task.
- For each task or work package, an estimate is made of the number of people needed in each labor grade, and the number of hours or days for each.
- This gives the distribution of labor hours or days required per labor grade.
- The labor hours for the various grades are then multiplied by their respective wage rates.

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Direct Non-Labor Expense

- Direct non-labor expense is the total expense of non-labor charges applied directly to the task.
- It includes subcontractors, consultants, travel, material costs, purchased parts, and freight.
- Direct non-labor expenses also include necessities for installation and operation, such as instruction and maintenance manuals, and spare parts.
- Note that these are costs incurred only for a specific work package.
- On smaller projects, the direct non-labor expenses are individually estimated for each work package.
- In larger projects, a simple percentage rate is applied to cover Direct Non-Labor.
- For example, 5 percent of direct labor cost might be included as travel expense, and 5 percent of material costs as freight.

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Overhead Expenses (Direct Overhead)

- Costs that can be allocated in a logical manner to specific projects.
- They include whatever is necessary to house and support the labor, including building rents, utilities, clerical assistance, insurance, and equipment.
- Usually, overhead is computed as a percentage of the direct labor cost.
- Frequently the rate is around 100 percent, but it ranges from as low as 25% for companies that do most of their work in the field to over 250% for those with laboratories and expensive facilities and equipment.

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General and Administrative Expense (Indirect Overhead)

- It includes taxes, financing, penalty and warranty costs, accounting and legal support, proposal expenses, marketing and promotion, salaries and expenses of top management, and employee benefits.
- For example, corporate level overhead would be allocated across all projects.
- Often, G&A overhead is charged on a time basis, so the longer the project duration, the greater the G&A expense for the project.

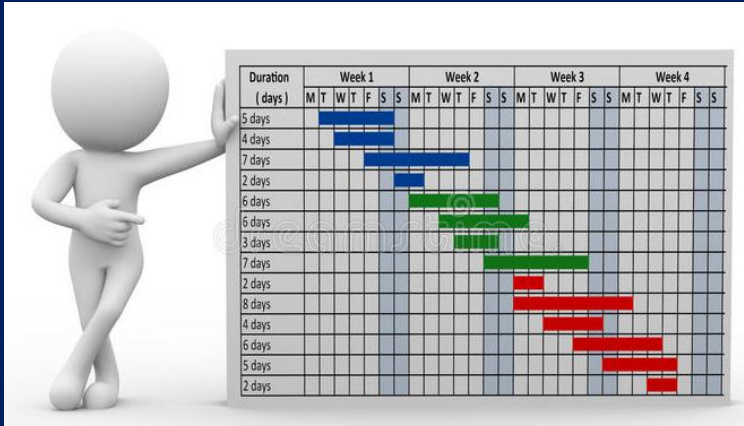
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Profit and Total Billing

- Profit is the amount left over after expenses have been subtracted from the contractual price.
- It can also be an agreed-to fixed fee or a percentage of total expenses, determined in part by the kind of contract.
- Total billing is the sum of total expenses and profit.
- Total billing and profit are included in estimates for the overall project, groups of work packages, and subcontracted work.
- They usually do not appear on budgets for lower-level work elements.

Creating a Time-Phased Budget



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Time-Phased Budget

- Simultaneous control of schedules and costs can be difficult, and the project manager needs a way to keep track of where expenses are accruing, how well the project is progressing, and where problems are developing.
- One way is with a time-phased budget, which consolidates the project budget and the project schedule.
- This budget shows how budgeted costs are distributed over time according to the project schedule.

Project CASTLEDate April 1, 1592Department ExcavatingWork package Moat

Charge	Rate	Months ⁺						Totals	
		1	2	3	4	5	6	Hours	Cost
Direct labor									
Professional	\$35/hour	50				50		100	3,500
Associate	\$30/hour								
Assistant	\$20/hour		100	100	100	100		400	8,000
Direct labor cost		1,750	2,000	2,000	2,000	3,750			11,500
Labor overhead	75%	1,312	1,500	1,500	1,500	2,813			8,625
Other direct cost*			100						100
Total direct cost		3,062	3,600	3,500	3,500	6,563			20,225
General/administrative	10%	306	360	350	350	657			2,023
Total costs		3,368	3,960	3,850	3,850	7,220			22,248
Profit	15%								
Billing total									

⁺Should extend for as many months as required by the project.

*Should be itemized to include costs for materials, freight, subcontracts, travel, and all other nonlabor direct costs.

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Time-Phased Budget

- In small projects, budgeting and cost monitoring is done using a single budget for the project as a whole. This budget is used to compare actual costs with budgeted costs throughout the project.
- On larger projects a single, project-wide budget is too insensitive.
- The better way is to subdivide the project budget into smaller budgets called ***control accounts*** or ***cost accounts***.
- Large projects have tens of control accounts; very large projects have hundreds.

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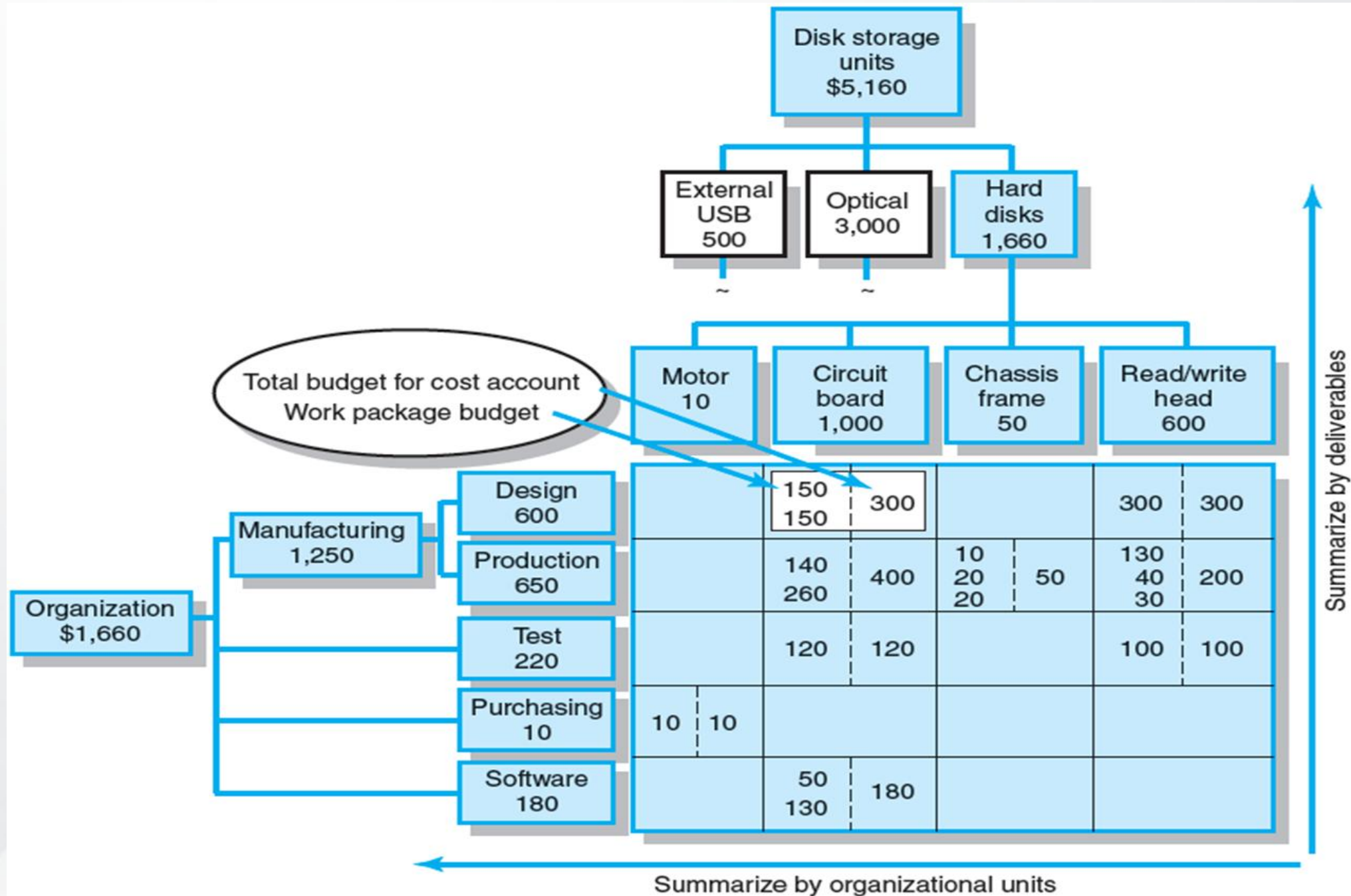
Creating a Time-Phased Budget

- By using information from your WBS and resource schedule, you can create a time-phased cost baseline.
- We integrated the WBS and OBS organization breakdown structure so the work packages could be tracked by deliverable and organization responsible.
- For each intersection point of the WBS/OBS matrix, you see work package budgets and the total cost.
- The total cost at each intersection is called a cost or control account.

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Creating a Time-Phased Budget

- For an example of the PC Prototype Project arranged by deliverable and organization unit responsible.
- For each intersection point of the WBS/OBS matrix, you see work package budgets and the total cost.
- For example, at the intersection of the Read/write head deliverable and the Production department we see there are three work packages with a total budget of \$200,000.
- The sum of all cost accounts in a column should represent the total costs for the deliverable.
- Conversely, the sum of the cost accounts in a row should represent the costs or budget for the organizational unit responsible to accomplish the work.



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Creating a Time-Phased Budget

- You can continue to “roll up” costs on the WBS/OBS to total project costs.
- This WBS provides the information you can use to time phase work packages and assign them to their respective scheduled activities over the life of the project.

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Creating a Time-Phased Budget

- The Circuit board work package has a duration of three weeks.
- Assuming labor, materials, and equipment are tracked separately, the work package costs for labor are distributed over the three weeks as they are expected to occur—\$40,000, \$30,000, and \$50,000 for each week, respectively.
- When the three-week work package is placed in the network schedule, the costs are distributed to the time-phased budget for the same three scheduled weeks.

Time-Phased Work Package Budget
Labor cost only

Work Package Description Test

Work Package ID 1.1.3.2.3

Deliverable Circuit board

Responsible organization unit Test

Work Package Duration 3 weeks

Page 1 of 1

Project PC Prototype

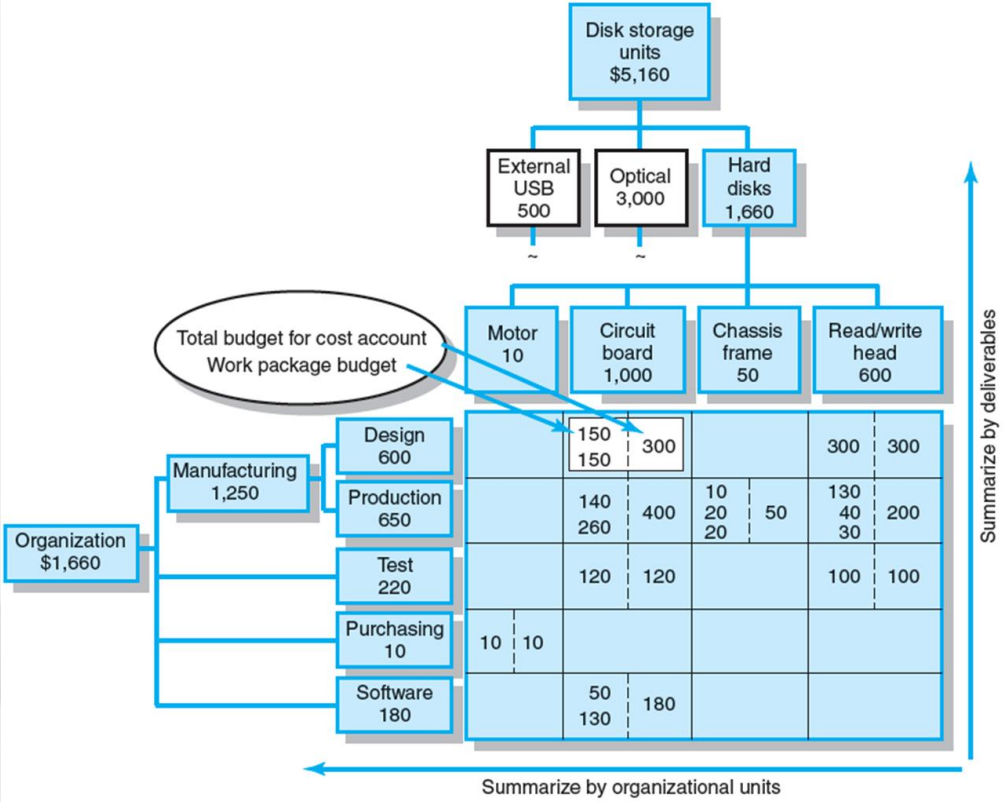
Date 3/24/xx

Estimator CEG

Total labor cost \$120,000

Time-Phased Labor Budget (\$000)

Work Package	Resource	Labor rate	Work Periods--Weeks					Total
			1	2	3	4	5	
Code 1.1.3.2.3	Quality testers	\$xxxx/week	\$40	\$30	\$50			\$120



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Creating a Time-Phased Budget

- In a few instances an activity will include more than one work package, where the packages are assigned to one responsible person or department and deliverable.
- In this case the work packages are consolidated into one activity. This activity includes two WPs.
- The first, WP-1.1.3.2.4.1 (Code), is distributed over the first three weeks.
- The second, WP-1.1.3.2.4.2 (Integration), is sequenced over weeks 3 and 4. The activity duration is four weeks.
- When the activity is placed in the schedule, the costs are distributed starting with the schedule start—\$20,000, \$15,000, \$75,000, and \$70,000, respectively.

Creating a Time-Phased Budget

Time-Phased Work Package Budget

Work Package Description	Software
1. Data Collection and Preprocessing	Python (Pandas, NumPy), MATLAB
2. Feature Extraction and Model Training	Python (Scikit-Learn, TensorFlow), MATLAB
3. Model Evaluation and Validation	Python (Scikit-Learn, TensorFlow), MATLAB
4. Deployment and Monitoring	Python (Flask, FastAPI), MATLAB

Page 1 of 1

Work Package ID 1.1.3.2.4.1 and 1.1.3.2.4.2

Project PC Prototype

Deliverable Circuit board

Date 3/24/xx

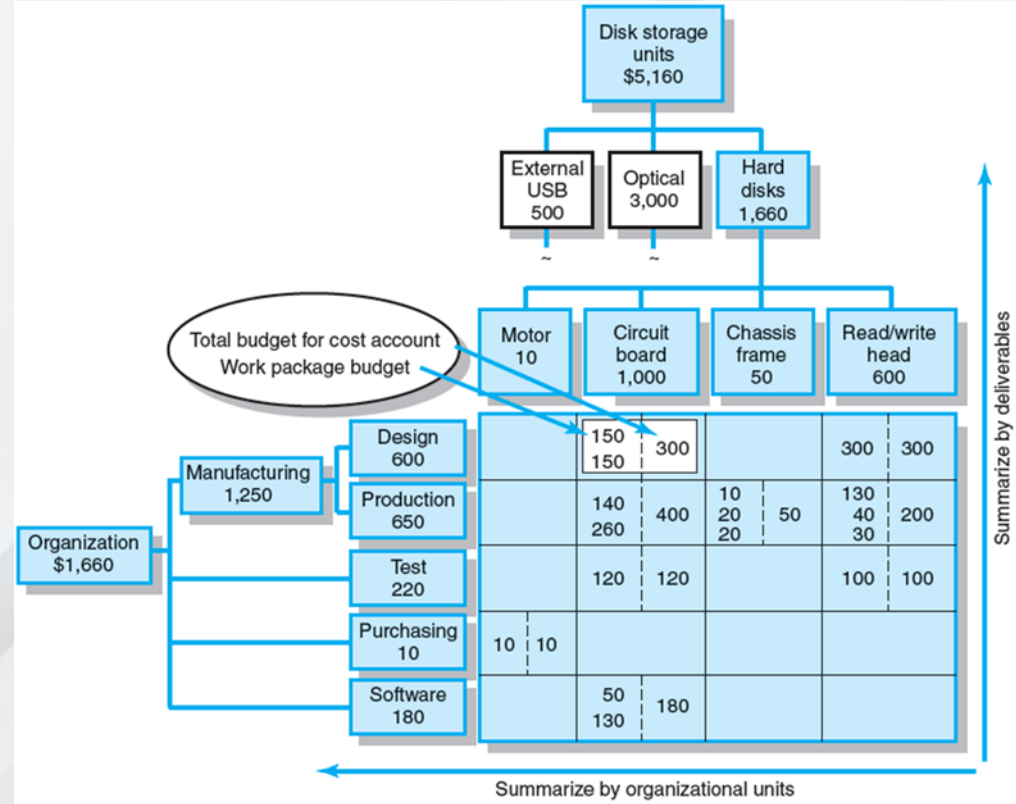
Responsible organization unit SoftwareEstimator LGG

Work Package Duration 4 weeks

Total labor cost \$180,000

Time-Phased Labor Budget (\$000)

Work Package	Resource	Labor rate	Work Periods--Weeks					
			1	2	3	4	5	Total
Code 1.1.3.2.4.1	Program'rs	\$2,000/ week	\$20	\$15	\$15			\$50
Integration 1.1.3.2.4.2	System/ program'rs	\$2,500/ week			\$60	\$70		\$130
Total			\$20	\$15	\$75	\$70		\$180

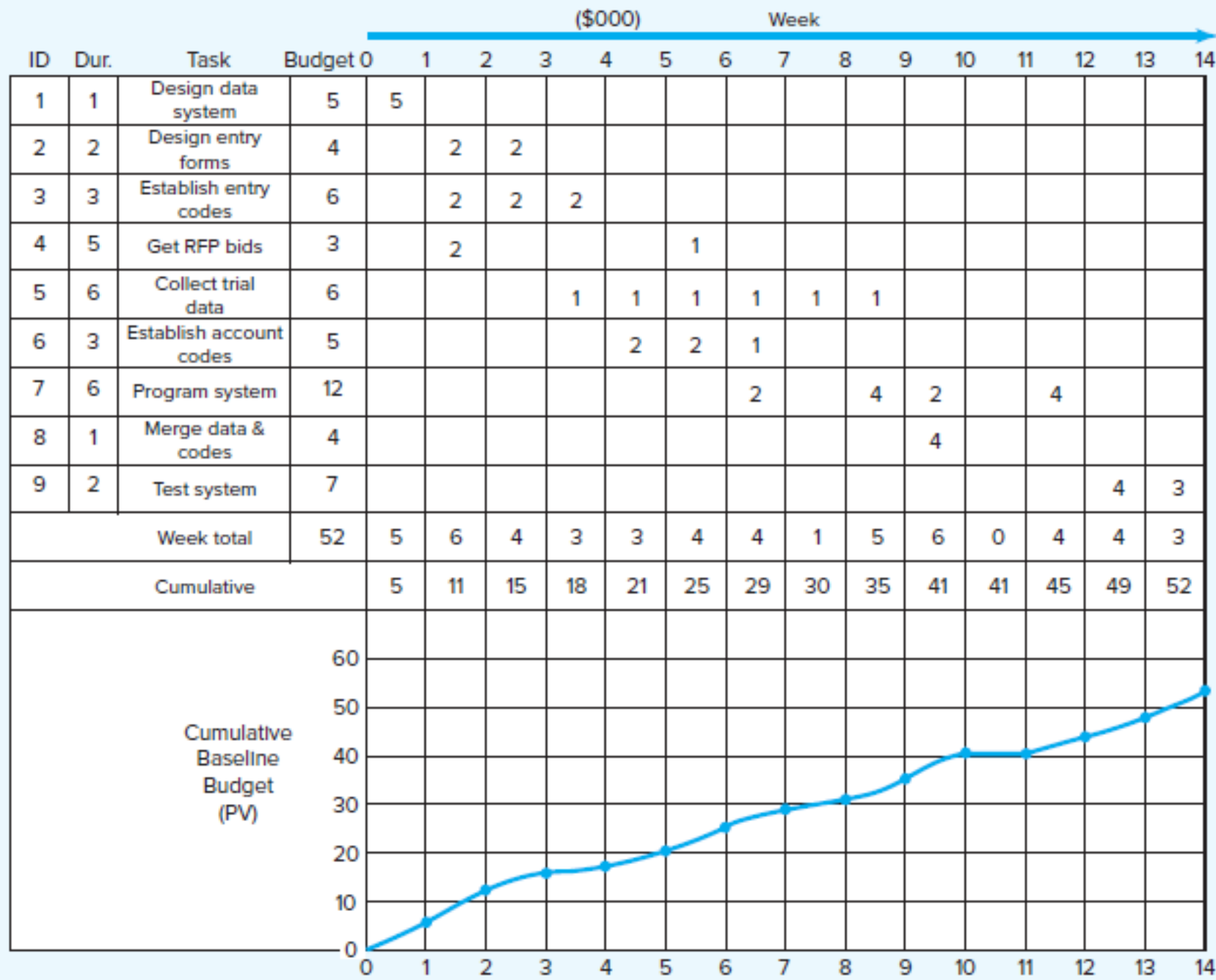


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Creating a Time-Phased Budget

- These time-phased budgets for work packages are lifted from your WBS and are placed in your project schedule as they are expected to occur over the life of the project.
- The outcome of these budget allocations is the project cost baseline (also called ***planned value—PV***), which is used to determine cost and schedule variances as the project is implemented.



Time-Phased
Work
Packages
Assigned

Project Monthly Cash Flow Statement

	January	February	March	April	May	June	July
CEBOO Project							
Hardware							
Hardware specifications	\$11,480.00	\$24,840.00	\$3,360.00				
Hardware design			\$23,120.00	\$29,920.00	\$14,960.00		
Hardware documentation					\$14,080.00	\$24,320.00	
Prototypes							
Order GXs							
Assemble preproduction models							
Operating system							
Kernel specifications	\$5,320.00	\$9,880.00					
Drivers							
OC drivers				\$3,360.00	\$12,320.00	\$11,760.00	\$12,880.00
Serial VO drivers							
Memory management							
Operating system documentation		\$10,240.00	\$21,760.00				
Network interface							
Utilities							
Utilities specifications				\$8,400.00			
Routine utilities				\$5,760.00	\$21,120.00	\$20,160.00	\$10,560.00
Complex utilities							
Utilities documentation				\$7,680.00	\$17,920.00		
Shell							
System integration							
Architectural decisions	\$20,400.00						
Integration first phase							
System H/S test							
Project documentation							
Integration acceptance test							
Total	\$37,200.00	\$44,960.00	\$48,240.00	\$55,120.00	\$80,400.00	\$56,240.00	\$23,440.00

	12/30	1/6	1/13	1/20	1/27	2/03
I. Suzuki	24 hrs	40 hrs	40 hrs	40 hrs	40 hrs	40 hrs
Hardware specifications				24 hrs	40 hrs	40 hrs
Hardware design						
Hardware documentation						
Operating system documentation						
Utilities documentation						
Architectural decisions	24 hrs	40 hrs	40 hrs	16 hrs		
J. Lopez	24 hrs	40 hrs	40 hrs	40 hrs	40 hrs	40 hrs
Hardware specifications				12 hrs	20 hrs	20 hrs
Hardware design						
Prototypes						
Kernel specifications				12 hrs	20 hrs	20 hrs
Utilities specifications						
Architectural decisions	24 hrs	40 hrs	40 hrs	16 hrs		
Integration first phase						
J.J. Putz				24 hrs	40 hrs	40 hrs
Hardware documentation						
Kernel specifications				24 hrs	40 hrs	40 hrs
Operating system documentation						
Utilities documentation						
Project documentation						
R. Sexon				24 hrs	40 hrs	40 hrs
Hardware specifications				24 hrs	40 hrs	40 hrs
Prototypes						
Assemble preproduction models						
OC drivers						
Complex utilities						
Integration first phase						
System H/S test						
Integration acceptance test						

Project Weekly Resource Usage Schedule

Budget Contingencies

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Budget Contingencies

The allocation of extra funds to cover uncertainties and improve the chance of finishing on time

Contingencies are needed because:

1. Project scope may change
2. Murphy's Law is present
3. Cost estimation must anticipate interaction costs
4. Normal conditions are rarely encountered

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Benefits To Contingency Funding

1. Recognizes future contains unknowns
2. Adds provision for company plans for an increase in project cost
3. Applies contingency fund as an early warning signal to potential
overdrawn budget

Why a Time-Phased Budget Baseline Is Needed

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Why a Time-Phased Budget Baseline Is Needed

- Scenario 1
 - Planned costs for the first five weeks are \$2,000,000.
 - Actual costs for the first five weeks are \$2,400,000.
- How are we doing? It would be easy to draw the conclusion there is a \$400,000 cost overrun.
- But we really have no way of knowing.
- The \$400,000 may represent money spent to move the project ahead of schedule.

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Why a Time-Phased Budget Baseline Is Needed

- Scenario 2
 - Planned costs for the first five weeks are \$2,000,000.
 - Actual costs for the first five weeks are \$1,700,000.
- Is the project costing \$300,000 less than we expected? Perhaps.
- But the \$300,000 may represent the fact that the project is behind schedule and work has not started.
- Could it be the project is behind schedule and over cost? We cannot tell from these data.

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Why a Time-Phased Budget Baseline Is Needed

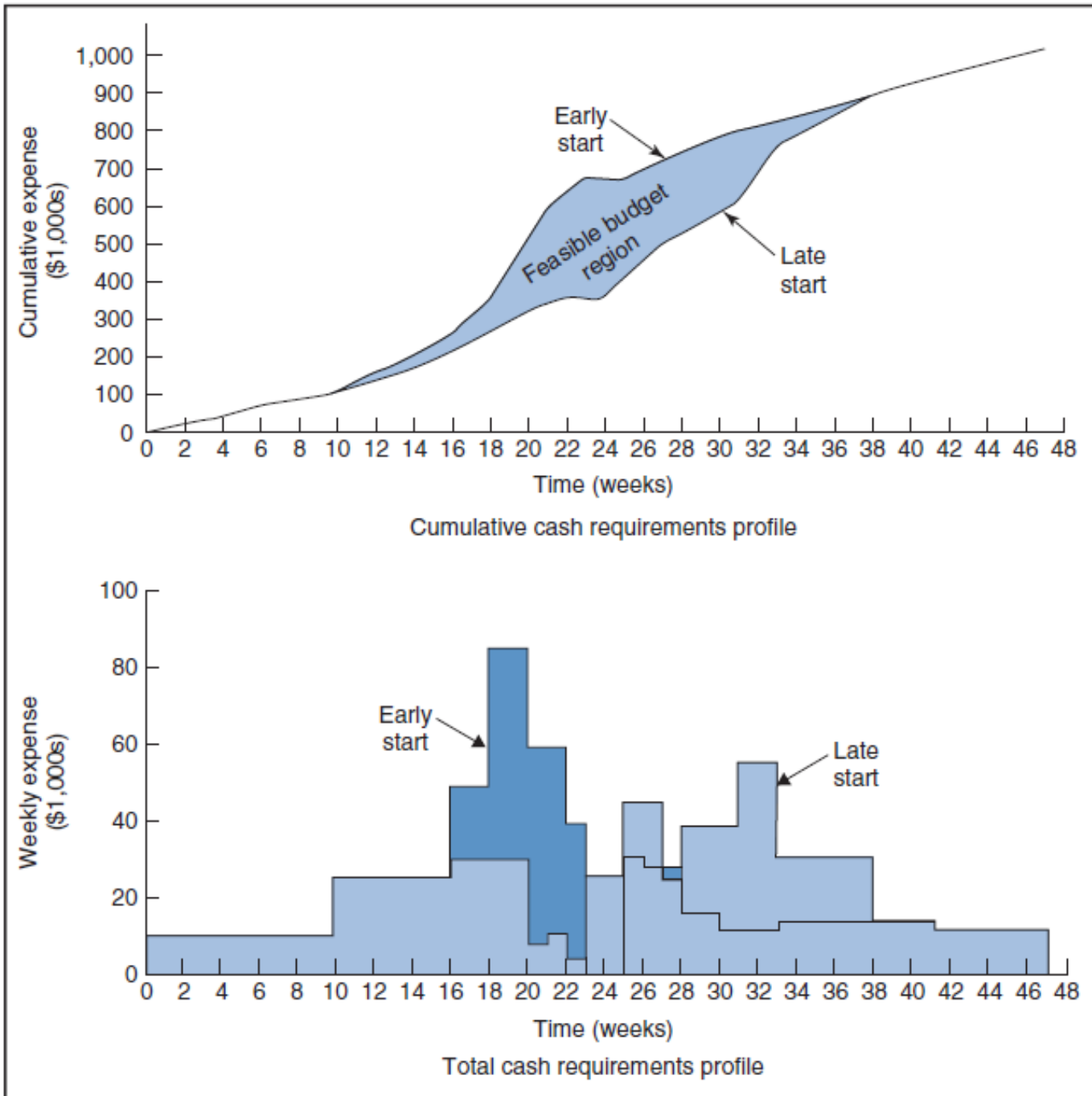
- The many systems found in the real world that use only planned funds (a constant burn rate) and actual costs can provide false and misleading information.
- These systems do not measure how much work was accomplished for the money spent!
- Hence, without time phasing cost to match your project schedule, it is impossible to have reliable information for control purposes.

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Cost Analysis with Early and Late Start Times

- It is possible to analyze what effect delaying activities will have on project costs.
- When funding restrictions constrain project expenditures, cost schedules reveal the places where the schedule must be changed.
- For example, Figure shows a peak weekly expense of \$82,000 in Weeks 18 and 19.
- If a weekly budget ceiling of \$60,000 per week were imposed on the project, then late start times would be preferred because they would result in a more “level” cost profile and peak expense of only \$54,000.
- The method for leveling resources is applicable to leveling project costs; costs are treated just as another resource.

Cost Analysis with Early and Late Start Times



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Cost Analysis with Early and Late Start Times

- Owing to the time value of money, the cost of work done farther in the future has a lower net present worth than the same work if done earlier.
- Delaying activities in a lengthy project can thus provide substantial savings in the present worth of project costs.
- Does this mean that activities should be delayed until their late start date? Not necessarily.
- Remember, delaying activities uses up slack time and leaves less extra time to deal with problems that could put the project behind schedule.

Summary of Today Session

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Project Budget

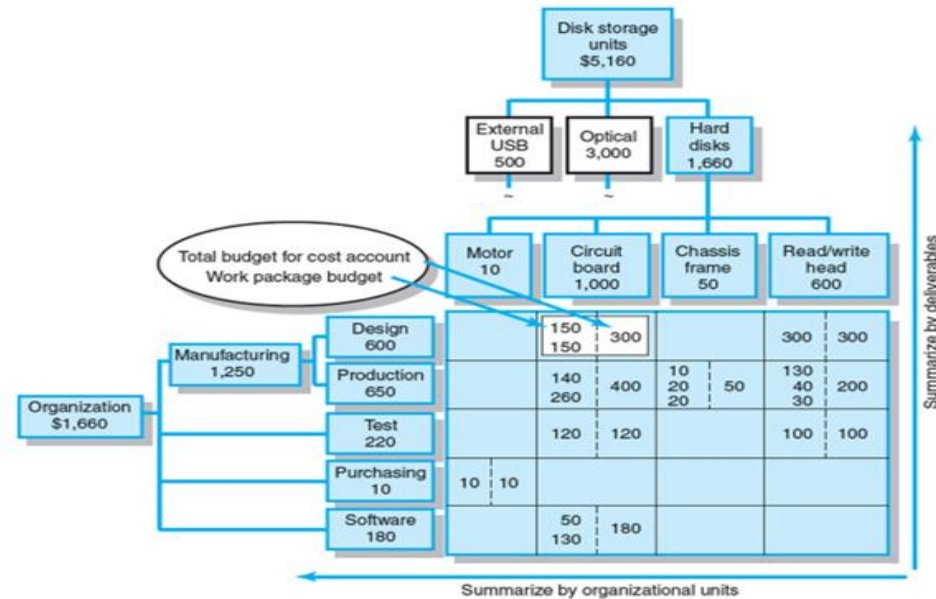
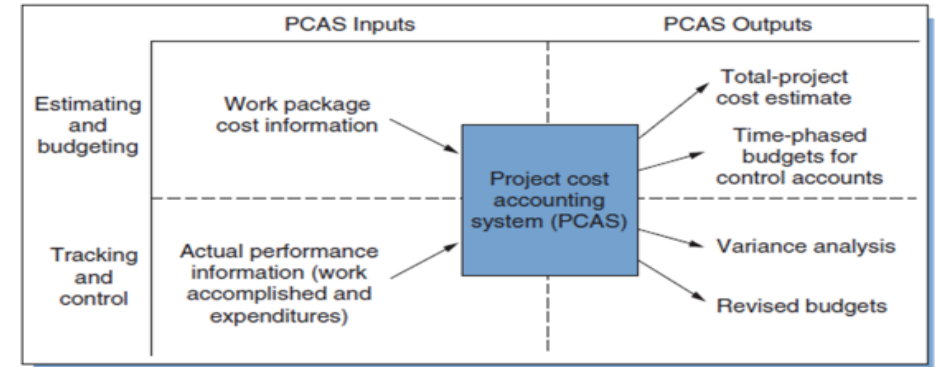
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Elements Of Budgets And Estimates

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 - Direct Labor Expense
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 - Profit and total billing

Project Cost Accounting Systems (PCAS)



Project <u>CASTLE</u>		Date <u>April 1, 1592</u>							
Department <u>Excavating</u>		Work package <u>Moat</u>							
Charge	Rate	Months ¹						Totals	
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Billing total									

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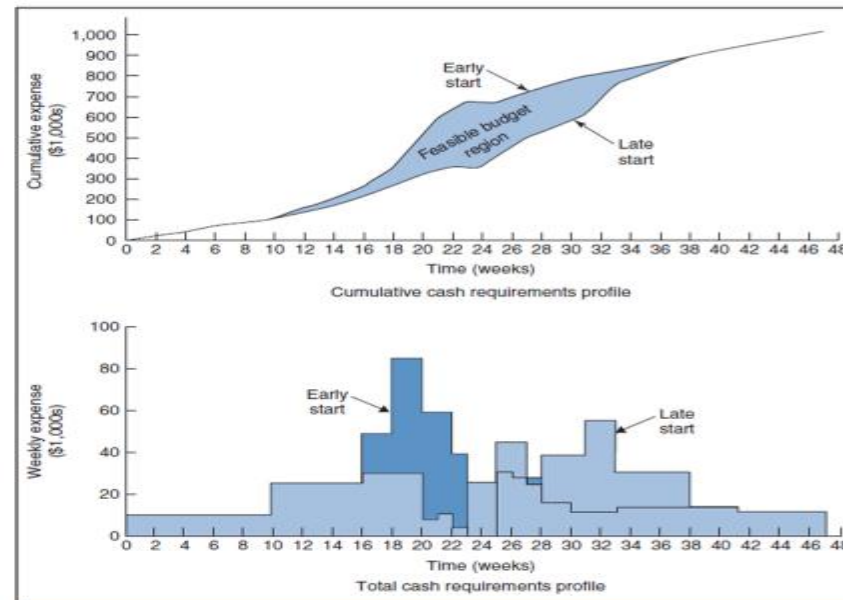
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Cost Analysis with Early and Late Start Times



Resources

- Project Management: The Managerial Process Fifth Edition. By: Erik W. Larson, Oregon State University, Clifford F. Gray, Oregon State University
- Project Management for Engineering, Business and Technology Fourth Edition. By: John M. Nicholas, Loyola University Chicago, Herman Steyn, University of Pretoria



Thank You