



مدیریت مالی، حسابداری و هزینه در پروژه ها و سازمان های پروژه محور

بخش نهم:

مدیریت هزینه: مدیریت هزینه پروژه

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

Earned value management system (EVMS)

GAO

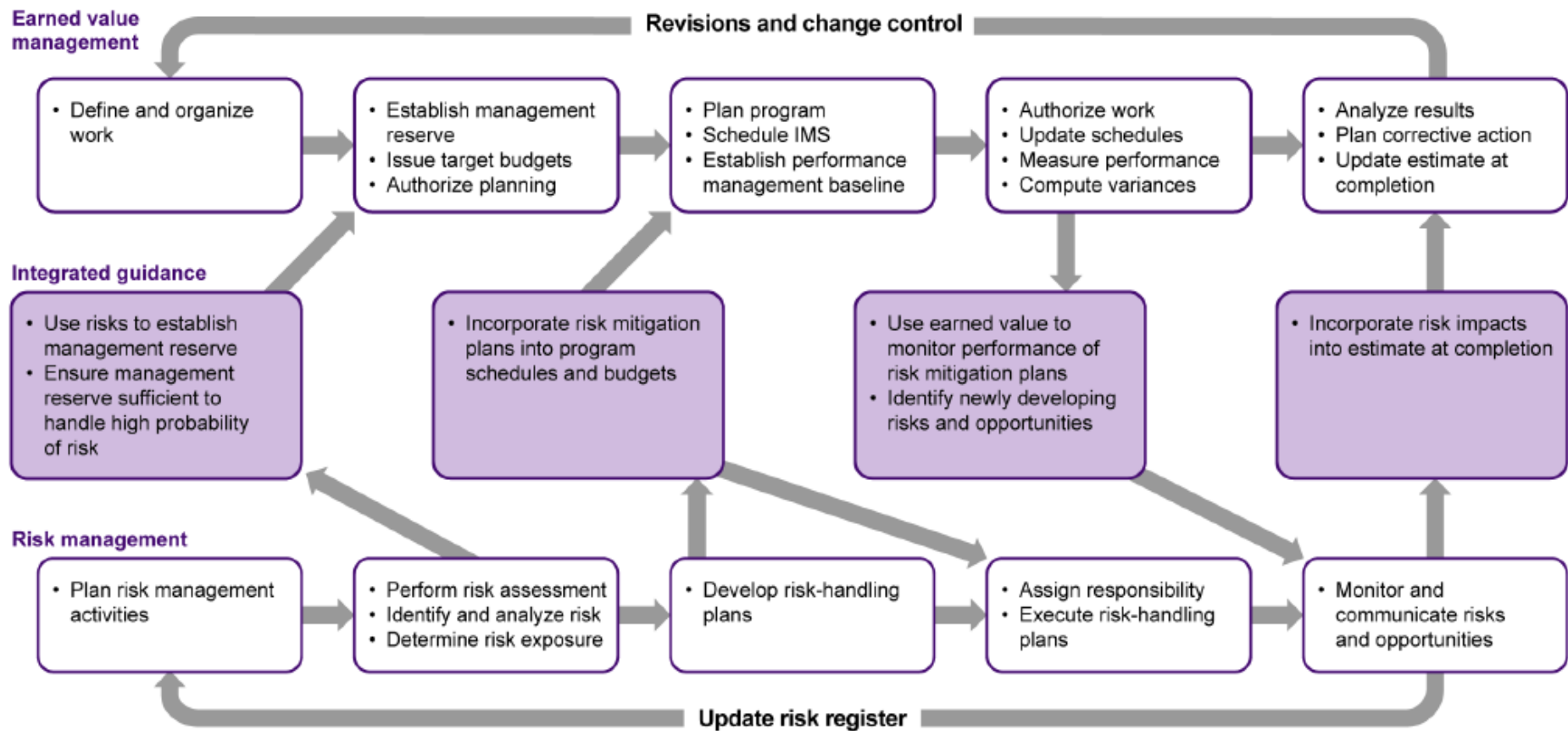
EVM Process

The EVM process can be broken down into thirteen fundamental activities, outlined and described in this section:

1. define the scope of effort with a WBS;
2. identify who in the organization will perform the work;
3. schedule the work to a timeline;
4. estimate resources and authorize budgets;
5. determine objective measures of earned value;
6. develop the performance measurement baseline;
7. execute the work plan and record all costs;
8. analyze EVM performance data and record variances from the performance measurement baseline (PMB) plan;
9. forecast estimates-at-completion (EACs) using EVM;
10. conduct an integrated cost-schedule risk analysis;
11. compare EACs from EVM (9) with EAC from risk analysis (10);
12. take management action to respond to risks; and
13. update the performance measurement baseline as changes occur.

STEP 12: Project analysis to management and take management action to mitigate risk

Figure 23: Integrating Earned Value Management and Risk Management



Source: Copyright © 2018, National Defense Industrial Association (NDIA), Integrated Program Management Division, *Earned Value Management Systems Application Guide*. All rights reserved. | GAO-20-195G

Steps 13: Update the PMB as changes occur and continue until program is complete

- ❑ Because changes are normal, the ANSI guidelines allow for **incorporating changes**—
***unless** it is a retroactive change to the performance data (with the exception of error correction)*
- ❑ When changes occur,
 1. **Both budgets and schedules** are reviewed and updated so that the EVM data stay current.
 2. EVM system should outline **procedures** for
 - i. Maintaining a log of all changes
 - ii. Incorporating them into the **performance measurement baseline**

Steps 13: Update the PMB as changes occur and continue until program is complete

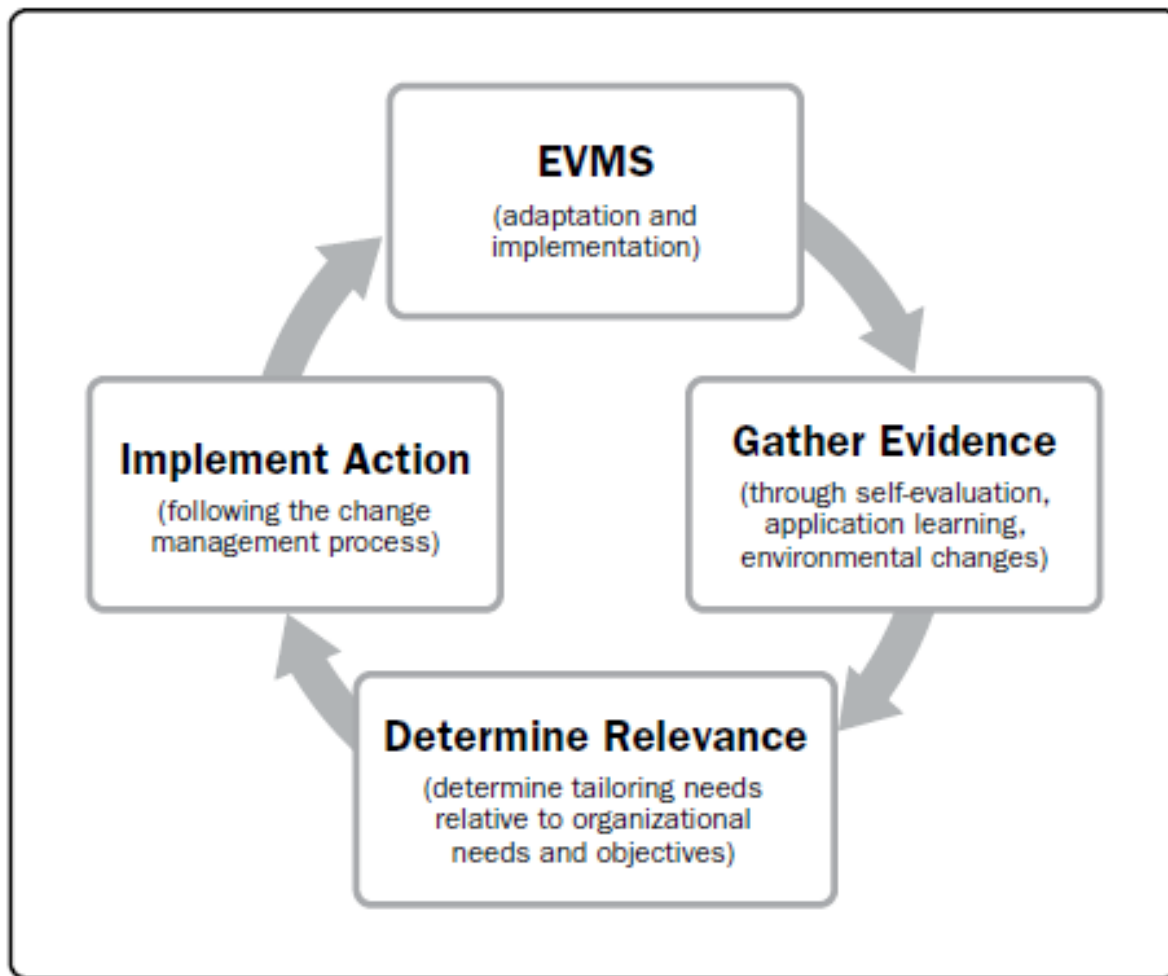


Figure 4-9. Process Improvement Evolution of EVMS

Steps 13: Update the PMB as changes occur and continue until program is complete

Change Number	Origination Date	Title/Description	WBS Elements Impacted
Justification	PMB Impact	Status	Completion Date

Figure 4-8. Change Log Example Information for a Change Request Affecting the Baseline

Steps 13: Update the PMB as changes occur and continue until program is complete

- ❑ If the new baseline is to provide management with **better program status**, a **decision** about whether to eliminate variances will have to be made.
- ❑ A single point adjustment—that is,
 1. Eliminating cumulative performance variances,
 2. Replanning the remaining work,
 3. Reallocating the remaining budgetto establish a new performance measurement baseline

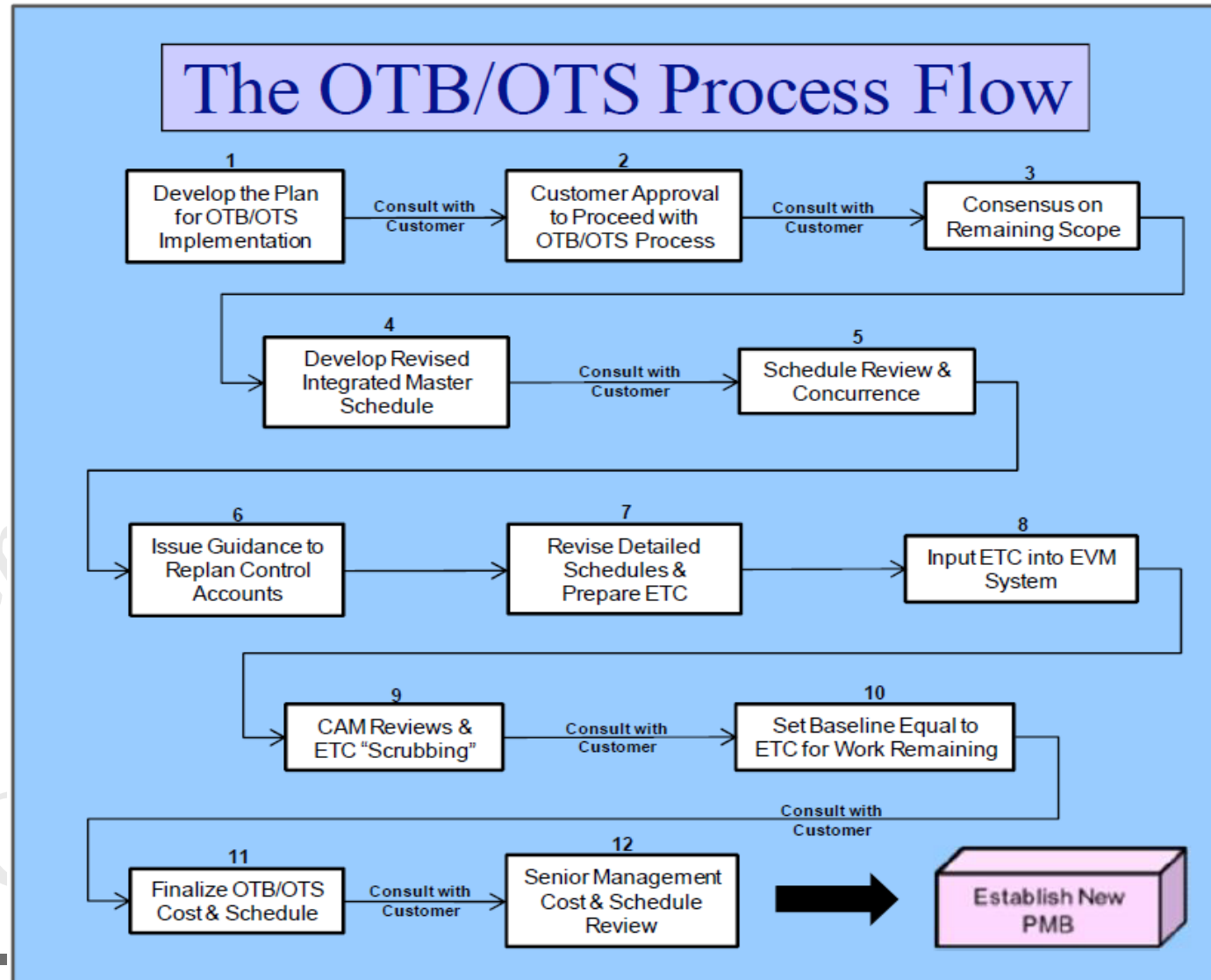
Steps 13: Update the PMB as changes occur and continue until program is complete



Over Target Baseline and Over Target Schedule Guide

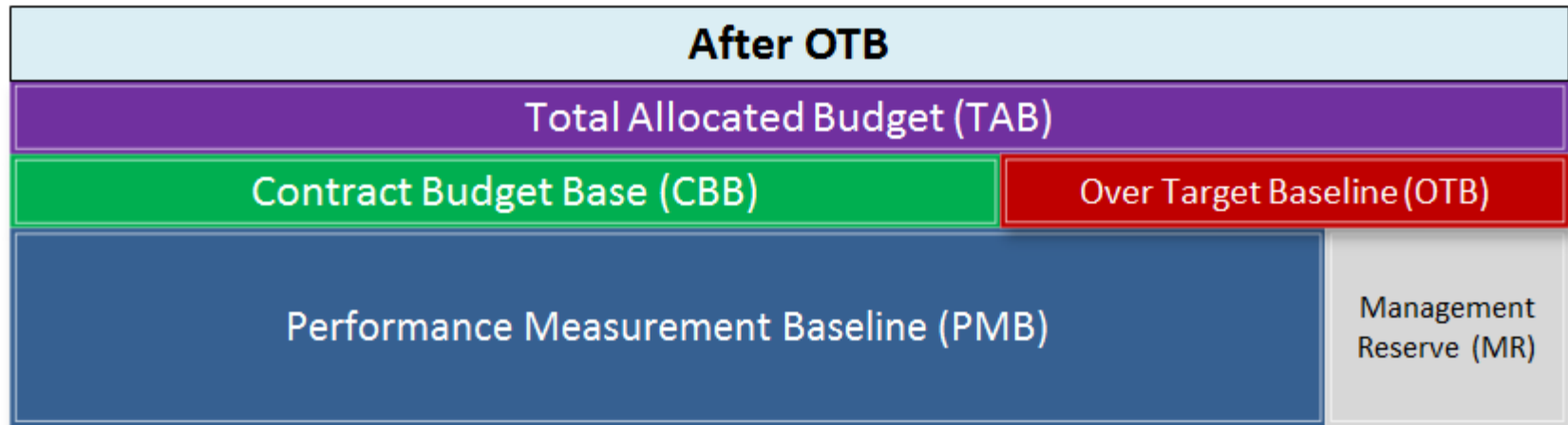
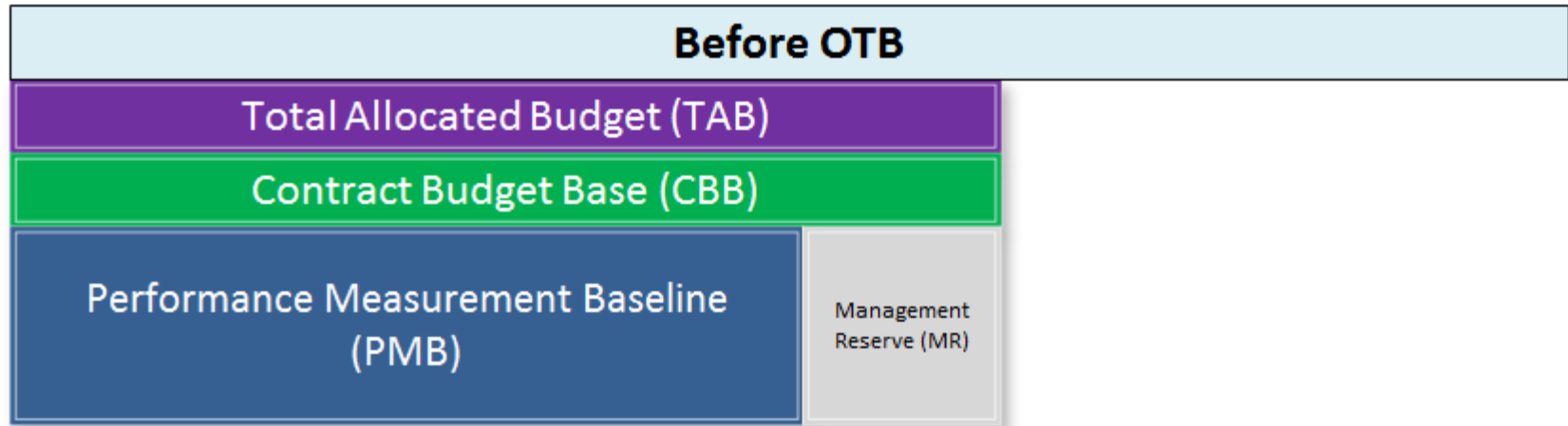
Steps 13: Update the PMB as changes occur and continue until program is complete

- ❑ Over Target Baseline (OTB)
- ❑ Over Target Schedule (OTS)



Steps 13: Update the PMB as changes occur and continue until program is complete

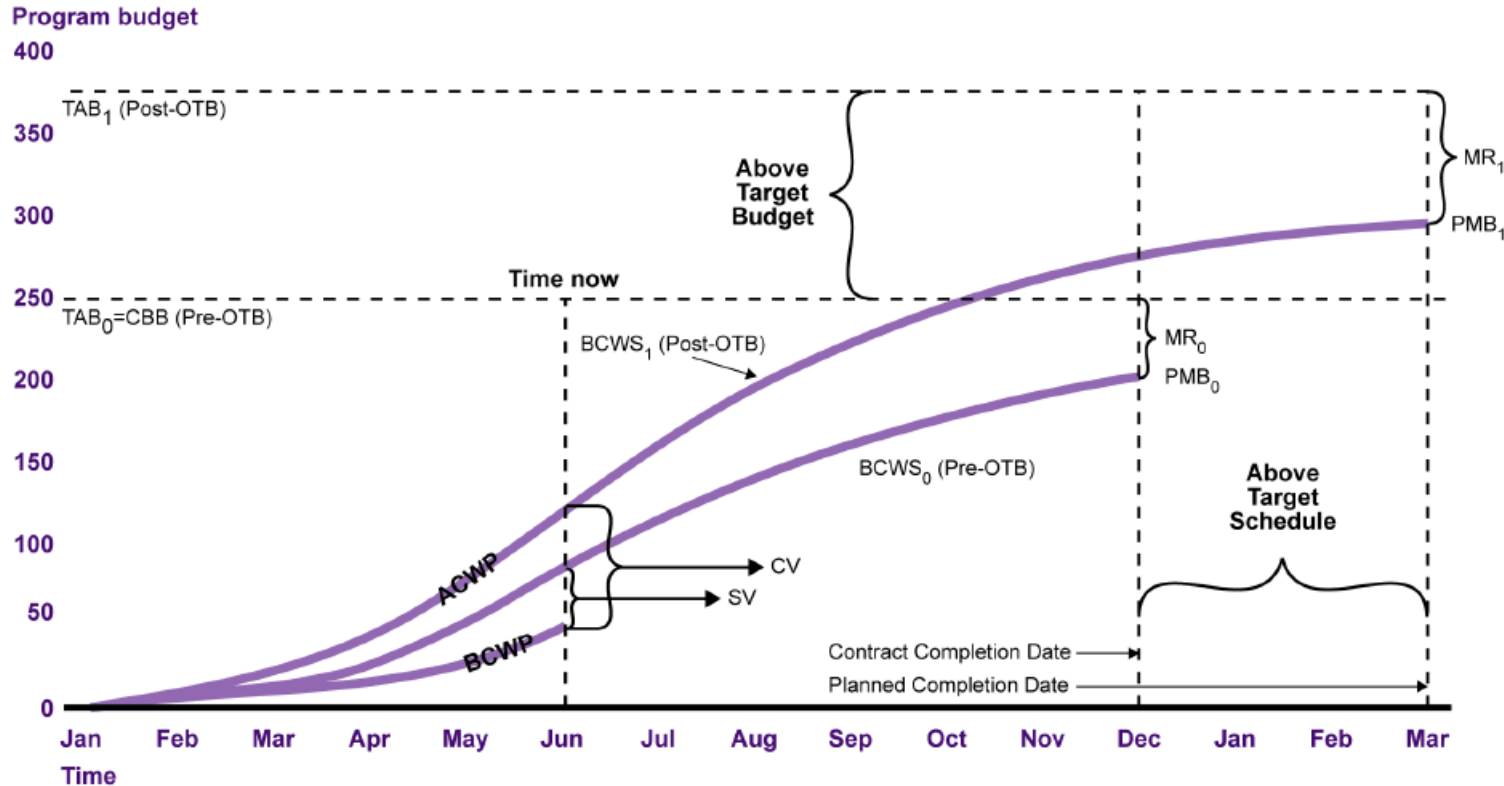
☐ Over Target Baseline (OTB)



Steps 13: Update the PMB as changes occur and continue until program is complete

❑ Over Target Baseline (OTB)

Establishing a New Baseline with a Single Point Adjustment



Source: DOD. | GAO-20-195G

Note: TAB = total allocated budget; CBB = contract budget baseline; OTB = overtarget budget; ACWP = actual cost of work performed; BCWP = budgeted cost of work performed; BCWS = budgeted cost of work scheduled; CV = cost variance; SV = schedule variance; MR = management reserve; PMB = performance management baseline.

Steps 13: Update the PMB as changes occur and continue until program is complete

Options for Treating Variances in Performing a Single Point Adjustment

Variance option	Description
Eliminate	
All variances	Eliminate cost and schedule variances for all work breakdown structure (WBS) elements by setting budgeted cost of work scheduled (BCWS) and budgeted cost of work performed (BCWP) equal to actual cost of work performed (ACWP). The most common type of variance adjustment, this normally generates an increase in BCWP and sometimes results in an adjustment to BCWS.
Schedule variance only	Cost variance is considered a valid performance measurement. The new performance measurement baseline retains the cost variance history but eliminates schedule variance by setting BCWS equal to BCWP, allowing revised planning for the remaining work and associated budgets.

Steps 13: Update the PMB as changes occur and continue until program is complete

Variance option	Description
Cost variance only	While rare, in some situations cost variance drives an overtarget budget but schedule information is valid. Cost variance is eliminated by setting BCWP equal to ACWP. The cumulative BCWP value is adjusted to match the cumulative cost variance. To preserve the existing schedule variance, the cumulative BCWS should be changed by the same amount as the BCWP. The contractor performance report will reflect positive adjustments to both in the current period following the overtarget budget.
Selected variances	If one WBS element or a subcontractor shows performance out of line with the baseline, management may implement an overtarget budget for only that portion of the contract. All other variances remain intact.
Retain	
All variances	A contractor may have been performing fairly well to the baseline plan with no significant variances, but additional budget is necessary to complete the work. Or, the contractor has large variances warranting an overtarget budget, but management wants to retain them. In both situations, cost and schedule variances are left alone but budget is added to cover future work in the overtarget budget process.

Source: GAO analysis of OSD's Over Target Baseline and Over Target Schedule Guide (Arlington, VA: December 5, 2012). | GAO-20-195G

Steps 13: Update the PMB as changes occur and continue until program is complete

SORRY BOX

I promised you to also review CII documents here
But since I added PMI and also those documents have cases,
they need one more session and we are out of time!
I will hopefully add them in 1402!

Project closeout audit

Close out consists of three steps

Project closeout audit

1. **Validate** and **correct** data
 2. Find areas where **performance** was **better than expected**
 3. Find areas where **performance** was **worse than expected**
- ☐ It is important that the project closeout audit **focuses on finding** and **fixing** problems rather than **blaming people**.
- ❖ If the project closeout audit becomes a **blame-placing game**, personnel will **hide the problems** **rather** than **identify them** and find ways to avoid them in the future.
 - ❖ The employees of a company cannot move down the **learning curve** if they **do not learn from their mistakes**.



مدیریت مالی، حسابداری و هزینه در پروژه ها و سازمان های پروژه محور

بخش دهم:

مدیریت مالی: آنالیز سود در سازمان پروژه محور

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

What you will learn?

- ☐ Introduction to profit center analysis
- ☐ Sources of profit – Methods and examples
- ☐ Allocation of general overhead – Methods and examples
- ☐ Profit center analysis based on crews
- ☐ Profit center analysis based on project management
- ☐ Profit center analysis based on estimators
- ☐ Profit center analysis based on types of projects
- ☐ Profit center analysis based on customers
- ☐ Profit center analysis based on equipment

Purposes of the this session

- ❑ Learn the **sources** of **profit** in projects.
- ❑ Learn to **analyze** the **profitability** of **different parts** of the **company**.
- ❑ Learn how to **allocate** **general overhead costs** to different **profit center**.
- ❑ Learn to **analyze** the **performance** of **crews**, **project management teams**, and **estimators**.
- ❑ Learn to **identify** which types of projects are **more profitable** to invest.
- ❑ Learn to **monitor** the **profitability** of **different customers** and **identify** which **customers** should be **developed** and which customers your company would be **better off without**.
- ❑ Learn to **analyze** **equipment costs** and **make decisions** based on **its performance**.

Introduction to profit center analysis

❑ Before **profits** can be **allocated** to **different activities**, we must **understand two things**:

1. **Sources of profit** on the company's core business
2. **How to allocate** the **general overhead costs** to the **different profit centers**.

Sources of profit

❑ At this step, there are up to **four sources** of **profit** on a **construction project**:

1. **Minimum profit and overhead markup** required by the company
2. **Profit** from the bidding (estimating) and buyout process
3. **Profit** from **individual crews**
4. **Profit** from the **project management team**

Sources of profit

❑ The needs for **profit calculation** to be **accurate**?

❖ **Budget** must be a **realistic estimate** of the cost to complete the project

✓ **Fat budgets:**

- Have **large contingencies**
- **Missing** items
- Have **underestimated costs**

that **distort** the **profit analysis**

Minimum profit and overhead markup

- ❑ Each company should establish a minimum profit and overhead markup that each project needs to:
 1. Cover **general overhead costs**
 2. Provide a **minimum profit** for the investors

- ❑ We discussed how to calculate minimum profit and overhead markup in **last session**.

- ❑ The **profit** from the **minimum profit and overhead markup** is easily determined by:
 - ❖ $Profit_{Min} = Budget \times P\&O \text{ Markup}$
 - ✓ The **budget** is the **budget to perform** the project **excluding** profit and overhead markup and is **not** the **contract price**

Minimum profit and overhead markup

- ❑ If the profit and overhead markup was **different** for each **cost category** (materials, labor, subcontract, equipment, and project overhead):
 1. The **profit** for **each cost category** would be **calculated**.
 2. The profit from the categories would be **added together**.

Minimum profit and overhead markup – Example 1

Example: Your company bid a project for \$1,000,000 that had a budget of \$820,000. The company's minimum profit and overhead markup is 15% for all cost categories. In addition, your company completed the project for \$812,000. What is the profit generated from the profit and overhead markup?

Solution:

$$\text{Profit}_{\text{Min}} = \text{Budget} \times \text{P\&O Markup} = \$820,000(0.15) = \$123,000$$

- ❖ In this example we earn more profit than minimum requirement:
- ❖ **$(\$1,000,000 - \$812,000) - \$123,000 = \$65,000 \text{ more}$**

Bidding and buyout process

- ☐ Profit or loss generated during the **bidding and buyout process** by the **estimator**.
- ☐ This is profit **in addition to the minimum profit and overhead markup** and is a **result** of:
 1. Skillful bidding
 2. Subcontracting
 3. Purchasing by the estimator

Bidding and buyout process

❑ How to increase markup?

1. **Purchase** of materials at **when** the costs are **cheaper**
2. **Identify** those **times** when the **market** will **allow** contractors to **charge higher** than normal prices for their work
 - ❖ **Contractor** should **track competitors' bidding habits** to find out **when** this **opportunity exist**
3. **Reduce construction costs** while **maintaining prices** to the project's **owners**:
 - ✓ Cheaper sources for subcontract work
 - ✓ Cheaper sources for materials
 - ✓ Higher productivity
 - ✓ Etc.

Bidding and buyout process

❖ How to estimate?

$$❖ \text{Profit}_{Est} = \text{Price} - \text{Budget} - \text{Profit}_{Min}$$

✓ If the **estimator** does a **poor job** during the **bidding and buyout process**, there could be a **loss** instead of a profit. This may occur because of:

1. Bidding the job too cheaply,
2. Poor estimation of costs, or
3. Error in the estimate.

Bidding and buyout process – Question

Question: Your company bid a project for \$1,000,000 that had a budget of \$820,000. The company's minimum profit and overhead markup is 15% for all cost categories. What is the profit generated from the profit and overhead markup?

Solution:

$$\text{Profit}_{\text{Min}} = \text{Budget} \times \text{P\&O Markup} = \$820,000(0.15) = \$123,000$$

$$\text{Profit}_{\text{Est}} = \text{Price} - \text{Budget} - \text{Profit}_{\text{Min}} = \$1,000,000 - \$820,000 - \$123,000 = \$57,000$$

$$\diamond \text{ Profit from P \& O} = \$65,000$$

- ❖ In this example we earn **more profit than minimum requirement** and **profit from bidding and buyout process: \$8,000 more.**

Profit from individual crews

❑ The third source of profit is profit from the **management** of labor and equipment by the crew's foreperson (in-house crews).

❖ **Equipment** is included here if the equipment is **used** and **managed** by the specific crews not the entire project

❑ The profit earned by the foreperson as part of management of the crews is the **difference** between the budget for the work performed by the crew and the actual cost to perform the work.

❖ This profit is calculated using the following equation:

$$✓ \text{Profit}_{\text{Crew}} = \text{Budget}_{\text{Crew}} - \text{Actual cost}_{\text{Crew}}$$

Profit from individual crews

- ❑ The **profit earned** by the management of the crews is a **function of two factors**:
 1. The **number of hours**—**labor** and **equipment**—it takes to complete the task
 2. The **hourly rates** for the **labor** and **equipment**.

- ❑ The **loss** here may be **due to**:
 1. **Poor scheduling** so that the task takes **more hours** to complete than it should.
 2. **Hourly costs** were higher than were needed **due to using** the **wrong class of workers** to complete the work.
 3. **Poor execution** of work

Profit from management of the project

- ❑ Includes **all work** and the **whole project** (excluding in-house crews)
 - ❖ **Equipment** is included as part of the management of the project when the equipment is **used** by the entire project and is managed by the **project management team**.
 - ✓ When it is **difficult** to **allocate** to only one or specific crews
- ❑ The profit earned by the **project management team** is the difference between the budget and the actual cost for the **entire project**, except for the work performed by the in-house crews, and is calculated using the following equation:
 - ❖ $Profit_{MGT} = Budget - Actual\ cost$

Sources of profit – Example 2

Example: Your company bid a project for \$1,000,000 that had a budget of \$820,000. The company's minimum profit and overhead markup is 15% for all cost categories. In addition, your company completed the project for \$812,000, of which \$125,000 was performed by in-house crews. The budgeted cost for the in-house work was \$130,000. Determine the profit generated by the estimator, project management, the crew, and the project.

Solution:

$$\text{Profit}_{\text{Min}} = \text{Budget} \times \text{P\&O Markup} = \$820,000(0.15) = \$123,000$$

$$\text{Profit}_{\text{Est}} = \text{Price} - \text{Budget} - \text{Profit}_{\text{Min}} = \$1,000,000 - \$820,000 - \$123,000 = \$57,000$$

$$\text{Profit}_{\text{Crew}} = \text{Budget}_{\text{Crew}} - \text{Actual cost}_{\text{Crew}} = \$130,000 - \$125,000 = \$5,000$$

$$\text{Profit}_{\text{MGT}} = \text{Budget} - \text{Actual cost} = (\$820,000 - \$130,000) - (\$812,000 - 125,000) = \$3,000$$

$$\text{Total profit} = \$123,000 + \$57,000 + \$5,000 + \$3,000 = \$188,000$$

$$\text{Total profit} = \$1,000,000 - \$812,000 = \$188,000$$

Sources of profit – Example 3

Example: Your company completed building a garage for the Winston. The costs are shown in Figure. The work in the grading and excavation, landscaping, roofing, and overhead door cost categories was done by subcontractors.

All concrete labor was performed by the company's concrete crew and the framing was done by the company's framing crew. The company's minimum profit and overhead markup is 20%. Determine the profit generated by the estimator, project management, the concrete crew, and the framing crew on this project.

Job: 408 Winston Garage			August 21, 2004			
<u>Code</u>	<u>Description</u>	<u>Contract Amount</u>	<u>Billed to Date</u>	<u>Costs</u>		
				<u>Actual</u>	<u>Budget</u>	<u>Overrun</u>
1000	General Conditions			3,275	3,400	-125
2100	Grading and Excavation			2,000	1,900	100
2700	Landscape			152	200	-48
3300	Footing and Found.-Labor			462	450	12
3400	Footing and Found.-Concrete			475	550	-75
3500	Slab/Floor-Labor			395	400	-5
3600	Slab/Floor-Concrete			1,964	2,000	-36
3900	Rebar			225	200	25
6110	Rough Carpentry			1,522	1,700	-178
6120	Lumber			2,257	2,200	57
7500	Roofing			850	850	0
8110	Metal Doors and Frames			243	250	-7
8300	Overhead Door			392	400	-8
9800	Paint			700	700	0
Job Total		20,000	20,000	14,912	15,200	-288

Costs for Winston Garage

Sources of profit – Example 3

Job: 408 Winston Garage			August 21, 2004			
Code	Description	Contract Amount	Billed to Date	-----Costs-----		
				Actual	Budget	Overrun
1000	General Conditions			3,275	3,400	-125
2100	Grading and Excavation			2,000	1,900	100
2700	Landscape			152	200	-48
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9800	Paint			700	700	0
Job Total		20,000	20,000	14,912	15,200	-288

Costs for Winston Garage

$$\text{Profit}_{\text{Min}} = \text{Budget} \times \text{P\&O Markup} = \$15,200(0.20) = \$3,040$$

$$\text{Profit}_{\text{Est}} = \text{Price} - \text{Budget} - \text{Profit}_{\text{Min}} = \$20,000 - \$15,200 - \$3,040 = \$1,760$$

Sources of profit – Example 3

Job: 408 Winston Garage				August 21, 2004		
Code	Description	Contract Amount	Billed to Date	-----Costs-----		
				Actual	Budget	Overrun
1000	General Conditions			3,275	3,400	-125
2100	Grading and Excavation			2,000	1,900	100
2700	Landscape			152	200	-48
3300	Footing and Found.-Labor			462	450	12
3400	Footing and Found.-Concrete			475	550	-75
3500	Slab/Floor-Labor			395	400	-5
3600	Slab/Floor-Concrete			1,964	2,000	-36
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9800	Paint			700	700	0
Job Total		20,000	20,000	14,912	15,200	-288

Costs for Winston Garage

- ❑ All **concrete labor** was performed by the **company's concrete crew** and the **framing** was done by the **company's framing crew**.
- ❖ The **loss** earned by the concrete crew = \$7 ($-5 + 12$)
- ❖ The **profit** earned by the **framing crew** is the cost savings for the rough carpentry or a profit of \$178.

Sources of profit – Example 3

Job: 408 Winston Garage			August 21, 2004			
Code	Description	Contract Amount	Billed to Date	Costs		
				Actual	Budget	Overrun
1000	General Conditions			3,275	3,400	-125
2100	Grading and Excavation			2,000	1,900	100
2700	Landscape			152	200	-48
3300	Footing and Found.-Labor			462	450	12
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Job Total		20,000	20,000	14,912	15,200	-288

Costs for Winston Garage

- ❑ The profit earned by the project management is the cost savings on the remaining items or a profit of **\$117** ($\$288 - (\$178 + \$5 - \$12)$).

Sources of profit – Example 3

Job: 408 Winston Garage				August 21, 2004		
Code	Description	Contract Amount	Billed to Date	Actual	Budget	Overrun
1000	General Conditions			3,275	3,400	-125
2100	Grading and Excavation			2,000	1,900	100
2700	Landscape			152	200	-48
3300	Footing and Found.-Labor			462	450	12
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8300	Overhead Door			392	400	-8
9800	Paint			700	700	0
Job Total		20,000	20,000	14,912	15,200	-288

Costs for Winston Garage

$$\text{Profit}_{\text{Min}} = \$3,040$$

$$\text{Profit}_{\text{Est}} = \$1,760$$

$$\text{Profit}_{\text{Crews}} = (-\$7) + \$178 = \$171$$

$$\text{Profit}_{\text{MGT}} = \$117$$

$$\boxed{\text{Total Profit}} = \$3,040 + \$1,760 + \$171 + \$117 = \$5,088$$

$$\boxed{\text{Total Profit}} = \$20,000 - \$14,912 = \$5,088$$

Allocation of general overhead

- ❑ To perform a **profit center analysis**, the **general overhead** needs to be **allocated**.
- ❑ There are a **number of methods** for **allocating general overhead**.
 - ❖ When allocating the general overhead, **each account of the general overhead** can be **allocated separately** using the method that is **most appropriate**.

Allocation of general overhead

❑ Different methods of general overhead allocation can be used in combination:

1. Revenue

- ❖ Based on the revenue of each project.
- ❖ This is not always appropriate. For example, profit centers that **rely heavily** on **in-house labor** often use **more of the general overhead** than profit centers that rely heavily on a few subcontractors.

2. Labor costs or hours

- ❖ For **unallocated labor**
- ❖ **Field employees travelling** between projects and cannot be tracked, then the **unallocated labor costs** allocated based on the **total labor costs** or **hours** labor worked in **each project**.

3. Material costs

- ❖ For **unallocated material**
- ❖ For example, **storage costs, deliver costs, etc.** **not charged** to **specific project**, then, the **unallocated material costs** allocated based on the **material costs** in **each project**.

Allocation of general overhead

❑ Different methods of general overhead allocation can be used in combination:

4. Actual or estimated usage of overhead

- ❖ Estimated usage based on judgement and saying that we used more unallocated resources for Project A compared to Project B.

5. Incremental

- ❖ Changes in overhead if they went away (**items removed**)
 - ❖ For example, a framing crew **requires** 10% of the payroll clerk's time. If by eliminating the framing crew the company is **unable** to reduce the **number of hours** the clerk works, the **incremental** cost of the clerk is **zero**. If by **eliminating the framing crew** the company could **eliminate the two hours** of overtime the clerk worked each week, the **incremental** cost of the clerk would be the **cost of the two hours of overtime**.

6. Arbitrary assignment

- ❖ More profitable, more general overhead
- ❖ Poor method

Allocation of general overhead – Example 4

Example: A company has two divisions. The first division consists of project management and generated \$4,523,367 of revenue during the year. The second division consists of three framing crews that generated \$1,080,238 in revenues during the year. Management has decided to allocate the office overhead of \$562,256 based on the percentage of the company's revenues generated by each of the profit centers, with one exception—\$8,264 of unallocated labor that will be allocated entirely to the second division. Determine the overhead allocated to each of the divisions.

Allocation of general overhead – Example 4

Solution: Of the overhead, \$553,992 (\$562,256 - \$8,264) will be allocated based on percentage of revenues.

The total revenues for the company are \$5,603,605 (\$4,523,367 + \$1,080,238) for the year. The general overhead allocated to the first division is calculated as follows:

$$\text{Overhead} = \$553,992 (\$4,523,367 / \$5,603,605) = \$447,196$$

The general overhead allocated to the second division is calculated as follows:

$$\text{Overhead} = \$553,992 (\$1,080,238 / \$5,603,605) + \$8,264 = \$115,060$$

Profit centers

❑ Previously, we saw that the **profit** from **a project** divided up into:

1. Minimum profit and overhead markup required by the company
2. Profit from the bidding (estimating) and buyout process
3. Profit from individual crews
4. Profit from the project management team

❑ By doing this **for all of the projects** and **totaling the profit**, the profit from operations may be used to **measure the successfulness** of the estimator, each crew, and each project management team.

Profit centers

❑ There are **three additional ways** of **dividing** the **profit** from operations:

1. Project type
2. Customer type
3. Profitability of each piece of heavy equipment

Profit centers

❑ Finally we have **six profit centers**:

1. Crews
2. Project management
3. Estimators
4. Types of projects
5. Customers
6. Equipment

The items mentioned above should also be evaluated in three areas

Now it is the time to evaluate profit centers!

Profit centers - Evaluation

- ❑ When **supervising the managers** of the profit centers, it is important to remember that **what gets measured and rewarded** is what **gets done**.
 - ❖ If the profit center managers are **only rewarded** for **meeting the schedule**, they will have **little incentive** to meet **profitability** and **quality objectives**.

So, what should have been measured in each profit centers?

Profit centers - Evaluation

❑ When **evaluating profit centers**, management should look at three areas:

1. Schedule
2. Quality
3. Financial performance

How managers evaluate different profit centers?

Profit centers – Evaluating crews

❑ Evaluating the crew is **important because**:

1. Hold the **supervisor accountable**
2. The **strength** and **weakness** of each crew to:
 - ✓ **Assign** the most appropriate **group** to the **project**.
 - ✓ **Know** where **more teaching and training** needed.
 - ✓ Take **corrective action**

*For example, management would like the **crews** with the **strongest scheduling** performance to **work on the most time-sensitive projects**.*

*In addition, when **management knows the weaknesses** of each of the crew, it knows **where more teaching and training** would be **most beneficial** and **where corrective action** is needed.*

Profit centers – Evaluating crews

- ❑ Management must look at **scheduling, quality, and financial performance** when measuring performance:

1. Schedule performance

- ✓ Determine the **success rate** in meeting **scheduled milestones**. For crews that work on a **single project** for a **long time**:

1. **SPI for milestones**

2. **SPI at regular intervals** (e.g., **at the end of every week**)

3. **Average SPI** for a **set period of time** (e.g., **the quarter**) as a **measure of the ability** to stay **on schedule between the milestones**

Profit centers – Evaluating crews

- ❑ Management must look at **scheduling**, **quality**, and **financial performance** when measuring performance:

2. Quality performance

- ❖ Performing **standardized quality inspections**. For example:

1. **Crew** may be **evaluated** against a **standard checklist**

- o The items may be **weighted** based on **their importance**.

2. The **quality standard** should be based on the **expected quality** of the **customers**

Remember Specifications?

Profit centers – Evaluating crews

- ❑ Management must look at **scheduling, quality, and financial performance** when measuring performance:

3. Financial performance

- ✓ May be measured against the **budget**. For crews that work on a **single project for a long time**:

1. **Labor cost performance index (LCPI)** at **regular intervals** (e.g., at the **end of every week**)

- $LCPI = BCLP / ACLP$

2. **Average LCPI** for a **set period of time** (e.g., the **quarter**) as a measure of the **ability to stay on labor budget** between the milestones

Profit centers – Evaluating crews

Work Days:

Estimated Hours/Day

Cumulative Hours

Actual Hours/Day

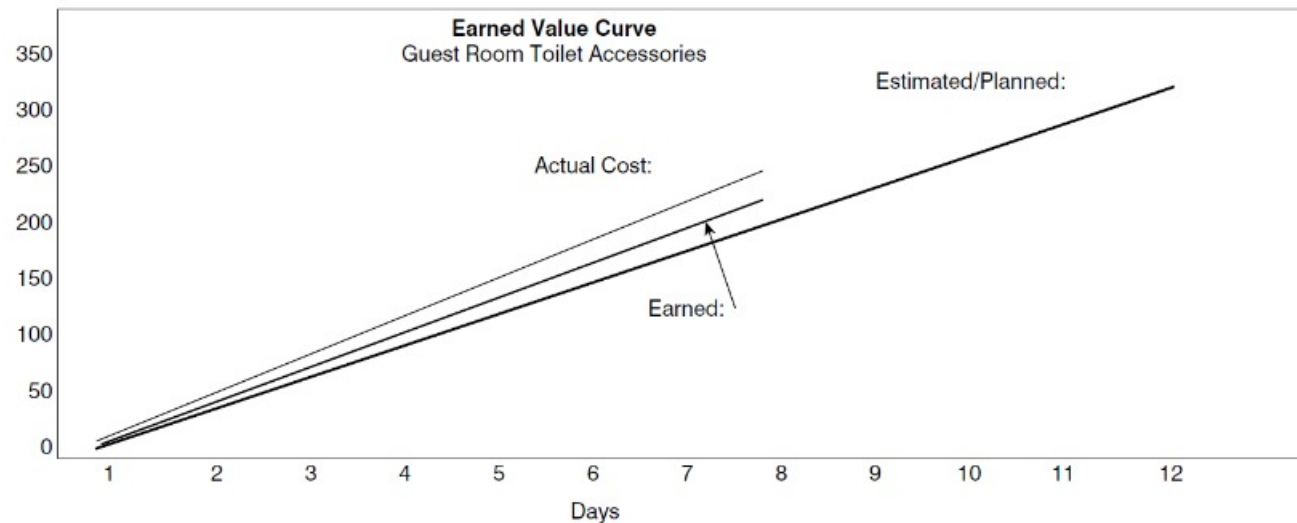
Cumulative Hours

Earned Hours/Day

Cumulative Hours

	1	2	3	4	5	6	7	8	9	10	11	12	Totals
Estimated Hours/Day	16	16	24	24	30	30	30	30	30	32	32	31	
Cumulative Hours	16	32	56	80	110	140	170	200	230	262	294	325	325
Actual Hours/Day	16	24	32	32	32	34	40	40					
Cumulative Hours	16	40	72	104	136	170	210	250					250
Earned Hours/Day	16	24	30	32	32	32	32	32					
Cumulative Hours	16	40	70	102	134	166	198	230					230

Man-hours:



Simple Analysis:

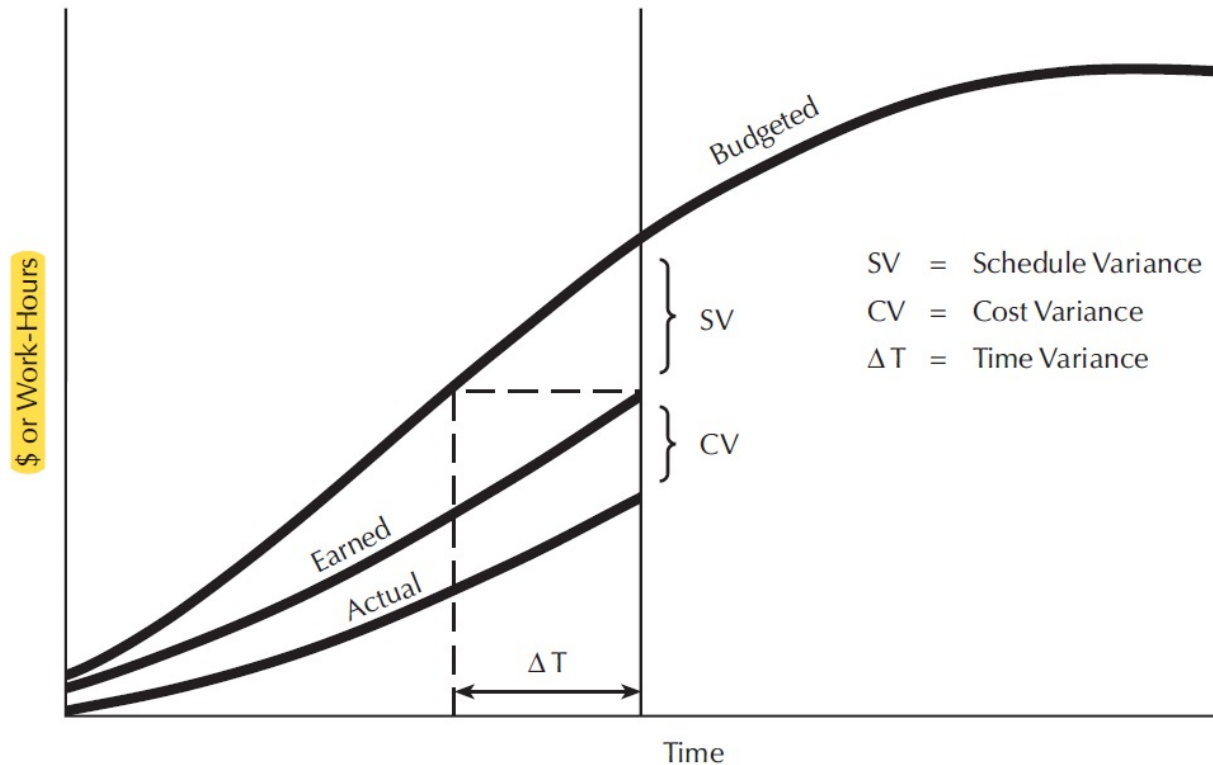
Cost: On day eight, the foreman had spent 250 hours, but earned 230, therefore he was 20 hours over budget.

This is the vertical measurement between the actual and earned curves.

Schedule: On day eight, the foreman had earned 230 hours but was not scheduled to have done so until approximately day nine, therefore he is approximately one day ahead of schedule. This is the horizontal measurement.

Earned value work package

Profit centers – Evaluating crews



Cost and Schedule Performance Graph

Profit centers – Evaluating crews

This simple method of recording the man-hours provides immediate and positive feedback to the project team and is, therefore, usually preferred to monitoring dollar expenditures. The advantage of estimating with unit man-hours (UMH) over unit prices for labor is that foremen and superintendents think in terms of crew size and duration; they do not think in terms of \$13 per square foot of sidewalks.

Profit centers – Evaluating crews

❑ Once the **three performance measurements** have been taken, they may be **evaluated against:**

1. Company standards
 1. Minimum standards
 2. Target level for the individual crew
2. Past performance
3. Other crews (internal or external)
4. Replacing the crew with a subcontractor

Profit centers – Evaluating crews

- ❑ These decision should be **reviewed periodically** (quarterly or annually) for each crew.
- ❑ When **comparing** crews to **subcontracting** the work out, the profit on labor is the **difference** between the **fair market value of the labor** and the **cost of performing the labor in-house**.
 - ❖ The **fair market value of the labor** should include **all costs** that would be borne by a **subcontractor**.
 - ✓ When determining the fair market value, **all change orders** should be included.

Profit centers – Evaluating project management

❑ Like evaluating the crew, evaluating **management teams** is **important** because:

1. Hold the **project manager** accountable
2. The **strength** and **weakness** of each project management team to:
 1. **Assign** the most **appropriate management team** to the project.
 2. **Know** where more **teaching and training** needed.
 3. Take **corrective action**

Profit centers – Evaluating project management

❑ Management must look at **scheduling, quality, and financial performance** when measuring performance:

- ❖ **Same** as **crews' performance** measurement
- ❖ Measured on a **single job** or a **group of jobs** occurring over a **period of time**.
- ❖ Additionally, should include some measurement of the **customers' satisfaction** with the **team's performance** in those **three areas**.

Profit centers – Evaluating project management

❑ Management must look at **scheduling, quality, and financial performance** when measuring performance:

❖ Additionally, should **customers' satisfaction** with the team's performance.

1. Schedule performance:

1. **How well** the management team **met turnover dates**
2. **How quickly** the **punch list** was **completed**
3. **How well** the **team coordinated** with the **owners' representatives** when dealing with:
 - Change orders,
 - Submittals,
 - Owner-supplied equipment,
 - Etc.

Profit centers – Evaluating project management

❑ Management must look at **scheduling, quality, and financial performance** when measuring performance:

❖ Additionally, should **customers' satisfaction** with the team's performance.

2. Quality performance:

1. Project's quality met the **customers' expectations**
2. How the **management team** handled **quality problems**

Profit centers – Evaluating project management

❑ Management must look at **scheduling**, **quality**, and **financial performance** when measuring performance:

❖ Additionally, should **customers' satisfaction** with the team's performance.

3. Financial performance:

1. Were **change orders** handled **fairly**?
2. Was the **billing fair** and **accurate**?
3. And for contracts **without** a **fixed price**, was the **budget** met?

Profit centers – Evaluating project management

❑ Once the **three performance** measurements have been taken, they may be **evaluated** against:

1. Company standards
 1. Minimum standards
 2. Target level for the individual project management team
2. Other project management teams (internal or external)
3. Past performance

Profit centers – Evaluating estimators

❑ Evaluating estimators is important so that management can:

1. Hold the **estimators accountable**
2. The **strength** and **weakness** of each project management team to:
 1. **Assign** the most **appropriate estimators** to the project.
 2. **Know** where more **teaching and training** needed.
 3. Take **corrective action**

Profit centers – Evaluating estimators

❑ Estimators should be rewarded for:

1. **Profit** that they **generate**
2. Performance in **finding subcontractors** and **suppliers** who:
 - ✓ Understand,
 - ✓ Committed to
 - ✓ Contractually tied to **scheduling** and **quality standards** required for the project.

*If their performance is measured based only on profit, **profit** will come at the **sacrifice of schedule and quality**. The **cheapest subcontractors and suppliers** will be **chosen without regard** to their **ability to meet the schedule** and **desired levels of quality**.*

Profit centers – Evaluating estimators

❑ Once the profit and performance in **generating profit** and **finding good subcontractors** and **suppliers** have been taken, they may be evaluated against:

1. Other estimators (internal or external)
2. Past performance

Profit centers – Evaluating types of projects

- ❑ One way to increase profitability is to **specialize** in **certain areas** of the industry.
- ❑ To identify those **areas** of the market that are **more profitable**, **each area** of **specialization** may be treated as a **profit center**. How? Follow the following steps:
 1. **Similar set** of **characteristics** are **grouped together**
 2. The **profitability** for the **group** of **jobs** is **calculated**.

Profit centers – Evaluating types of projects

❑ Jobs may be **grouped** by **one or more** of the **following characteristics**:

- ❖ **Similar customer** base (such as **residential customers**),
- ❖ **Similar types of buildings** (such as **type V wood framed buildings**),
- ❖ **Similar location** (such as **a city or state**),
- ❖ Etc.

Profit centers – Evaluating types of projects

❑ Once the **groups have been established**, the **profitability** may be **calculated** for each **group and compared to**:

1. Company standards
 1. Minimum standards
 2. Target level for the each types of projects
2. Other project types

But how to do the comparison?

Profit centers – Evaluating types of projects

❑ This comparison **may** be based on **one or more** of the **following methods**:

1. The actual gross profit margin at the completion of the projects

a. In-progress projects (over a specified period of time)

b. Completed projects

❖ How to calculate?

I. *Gross profit = Revenues – Project Costs (including project overhead)*

II. *Gross profit margin (ratio): Gross profit / Revenue*

Should we make decisions between projects only based on this comparison?

Let's see

Profit centers – Evaluating types of projects – Example 5

Example: Your company worked on the projects shown in Table during the last year. The duration in Table represents the number of months during the year that the project was under construction. Analyze the different profit centers based on their gross profit margins.

Work Performed During the Year

Profit Center	Revenue (\$)	Gross Profit (\$)	Average Monthly Investment (\$)	Duration Months
Apartment	3,000,000	153,000	187,000	8
Apartment	2,017,000	110,000	183,000	11
Apartment	1,542,000	75,000	108,000	5
Condo	642,000	51,000	88,000	7
Condo	1,600,000	110,000	160,000	10

Profit centers – Evaluating types of projects – Example 5

Solution: The gross profit and revenue for the apartment profit center is as follows:

$$\text{Gross Profit} = \$153,000 + \$110,000 + \$75,000 = \$338,000$$

$$\text{Revenue} = \$3,000,000 + \$2,017,000 + \$1,542,000 = \$6,559,000$$

$$\text{Gross Profit Margin} = \$338,000 / \$6,559,000 = 0.0515 \text{ or } 5.15\%$$

□ The gross profit margin for the condominium profit center is calculated in the same manner:

$$\text{Gross Profit} = \$51,000 + \$110,000 = \$161,000$$

$$\text{Revenue} = \$642,000 + \$1,600,000 = \$2,242,000$$

$$\begin{aligned} \text{Gross Profit Margin} &= \$161,000 / \$2,242,000 \\ &= 7.18\% \end{aligned}$$

Work Performed During the Year

Profit Center	Revenue (\$)	Gross Profit (\$)	Average Monthly Investment (\$)	Duration Months
Apartment	3,000,000	153,000	187,000	8
Apartment	2,017,000	110,000	183,000	11
Apartment	1,542,000	75,000	108,000	5
Condo	642,000	51,000	88,000	7
Condo	1,600,000	110,000	160,000	10

Based on the gross profit margin, the condominium projects are more profitable.

Profit centers – Evaluating types of projects

- ❑ This comparison may be based on **one or more** of the **following methods**:

2. Return on cash invested

- ❖ The **return on investment** for the **profit center** may be **estimated** by:

Gross profit for a specified period of time (often a year) / average investment in the projects for that same period of time.

Profit centers – Evaluating types of projects

- ❑ Management may find that **certain types** of projects have a **lower return on investment**, even though they have a **higher** than average **gross profit margin**. This may be **due to**:
 - ✓ Slow payments from the owners
 - ✓ Owners who require a higher retention rate
 - ✓ The projects use fewer subcontractors
 - ✓ Etc.

As a result, *management* may want to *increase* the *profit and overhead markup* for *this group* of projects.

Should we make decisions between projects only based on this comparison?

Let's see

Profit centers – Evaluating types of projects – Example 6

Example: Your company worked on the projects shown in Table during the last year. The duration in Table represents the number of months during the year that the project was under construction. Analyze the different profit centers based on their return on cash invested in the projects.

Work Performed During the Year

Profit Center	Revenue (\$)	Gross Profit (\$)	Average Monthly Investment (\$)	Duration Months
Apartment	3,000,000	153,000	187,000	8
Apartment	2,017,000	110,000	183,000	11
Apartment	1,542,000	75,000	108,000	5
Condo	642,000	51,000	88,000	7
Condo	1,600,000	110,000	160,000	10

Profit centers – Evaluating types of projects – Example 6

❑ **Solution:** Gross Profit = \$153,000 + \$110,000 + \$75,000 = \$338,000

The **average investment** for the **apartment profit center** is the **weighted average** of the **average monthly investments** in each of the projects.

The **average monthly investment** for the **apartment profit center** is as follows:

$$\text{Investment} = \$187,000 (8/12) + \$183,000 (11/12) + \$108,000 (5/12) = \$337,417$$

$$\text{Return} = \$338,000 / \$337,417 = 1.0017 \text{ or } 100.17\%$$

Work Performed During the Year

Profit Center	Revenue (\$)	Gross Profit (\$)	Average Monthly Investment (\$)	Duration Months
Apartment	3,000,000	153,000	187,000	8
Apartment	2,017,000	110,000	183,000	11
Apartment	1,542,000	75,000	108,000	5
Condo	642,000	51,000	88,000	7
Condo	1,600,000	110,000	160,000	10

Profit centers – Evaluating types of projects – Example 6

Solution: The **average monthly investment** and the **return on cash investment** in the **condominium profit center** projects are as follows:

$$\text{Gross Profit} = \$51,000 + \$110,000 = \$161,000$$

$$\text{Investment} = \$88,000 (7/12) + \$160,000 (10/12) = \$184,667$$

$$\text{Return} = \$161,000 / \$184,667 = 0.8718 \text{ or } 87.18\%$$

Based on the return on investment, the apartment projects are more profitable.

Work Performed During the Year

Profit Center	Revenue (\$)	Gross Profit (\$)	Average Monthly Investment (\$)	Duration Months
Apartment	3,000,000	153,000	187,000	8
Apartment	2,017,000	110,000	183,000	11
Apartment	1,542,000	75,000	108,000	5
Condo	642,000	51,000	88,000	7
Condo	1,600,000	110,000	160,000	10

Profit centers – Types of projects

❑ This comparison may be based on **one or more** of the **following methods**:

3. Consumption on management's time

- ❖ **Management's time** is a limited resource that **limits** the **number of projects** that a company can perform.
- ❖ If projects **consume more** of **management's time** than is available, then **additional management** must be hired, **increasing** the cost of **general overhead**.
 - ✓ If additional management **is not hired**, the **effectiveness** of existing **management** is **reduced**, resulting in **higher cost** due to **poor cost control**.

Profit centers – Types of projects

- ❑ By looking at this comparison, management may determine if they could earn more profit by:
 - ✓ Focusing on obtaining projects that do not consume a lot of management's time.
 - ✓ Increasing the profit and overhead markup on projects that require a lot of management's time.

Should we make decisions between projects only based on this comparison?

Profit centers – Evaluating types of projects – Example 7

Example: Analyze the different profit centers in Table based on their use of management's time. One project manager can oversee four apartment projects or two condominium projects.

Work Performed During the Year

Profit Center	Revenue (\$)	Gross Profit (\$)	Average Monthly Investment (\$)	Duration Months
Apartment	3,000,000	153,000	187,000	8
Apartment	2,017,000	110,000	183,000	11
Apartment	1,542,000	75,000	108,000	5
Condo	642,000	51,000	88,000	7
Condo	1,600,000	110,000	160,000	10

Profit centers – Evaluating types of projects – Example 7

Solution: The monthly profit generated by each apartment project is as follows:

- Profit1 = $\$153,000/8 = \$19,125$
- Profit2 = $\$110,000/11 = \$10,000$
- Profit3 = $\$75,000/5 = \$15,000$

- The **average monthly profit** generated by an apartment project is as follows:

$$\text{Profit} = (\$19,125 + \$10,000 + \$15,000)/3 = \$14,708$$

On average an apartment project takes 25% of a project manager's time in each month. Running at full capacity, a project manager would generate the following profit per month:

$$\text{Profit} = \$14,708/0.25 = \$58,832$$

Work Performed During the Year

Profit Center	Revenue (\$)	Gross Profit (\$)	Average Monthly Investment (\$)	Duration Months
Apartment	3,000,000	153,000	187,000	8
Apartment	2,017,000	110,000	183,000	11
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Condo	642,000	51,000	88,000	7
Condo	1,600,000	110,000	160,000	10

Profit centers – Evaluating types of projects – Example 7

The **monthly profit** generated by **each condominium project** is as follows:

- Profit1 = $\$51,000/7 = \$7,286$
- Profit2 = $\$110,000/10 = \$11,000$

The **average monthly profit** generated by **a condominium project** is as follows:

$$\text{Profit} = (\$7,286 + \$11,000)/2 = \$9,143$$

On average a condominium project takes 50% of a project manager's time in each month. Running at full capacity, a project manager would generate the following profit per month:

$$\text{Profit} = \$9,143/0.50 = \$18,286$$

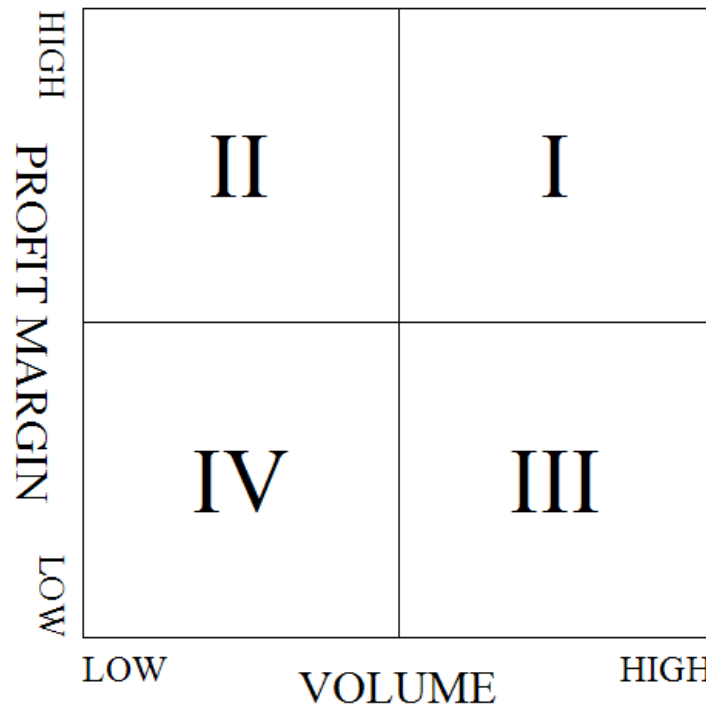
Work Performed During the Year

Profit Center	Revenue (\$)	Gross Profit (\$)	Average Monthly Investment (\$)	Duration Months
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Condo	642,000	51,000	88,000	7
Condo	1,600,000	110,000	160,000	10

Based on the management time, the apartment projects are more profitable.

Profit centers – Evaluating customers

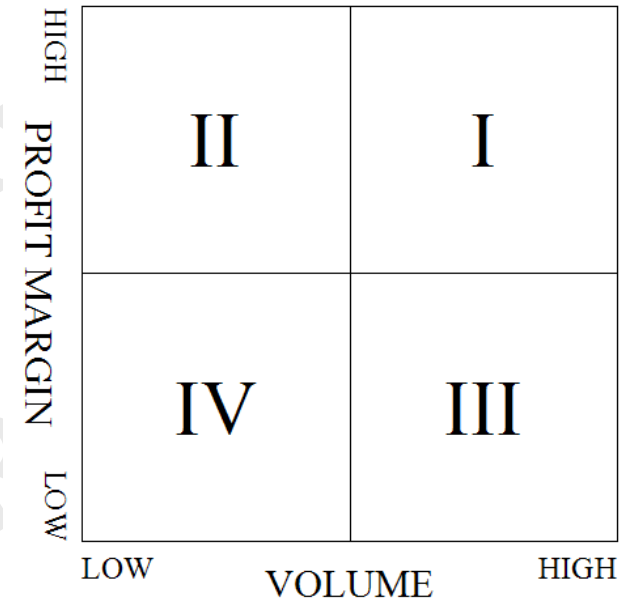
- ❑ Calculate and determine the **volume** and **profit** attributed to **each customer**.
- ❑ Once the data has been collected, customers are **plotted** in the **matrix**.



Profit centers – Evaluating customers

❑ Customers in Quadrant I:

- ❖ Company's best customers.
- ❖ They are the company's **most profitable customers**.
- ❖ **Expand** the **volume** of work performed.
- ❖ **Ensure** that these **customers' needs** are being **met**.
 - ✓ That these customers **have no reason** to take their **business elsewhere**.



Profit centers – Evaluating customers

❑ Customers in Quadrant II:

❖ Provide an occasional job at a high profit margin.

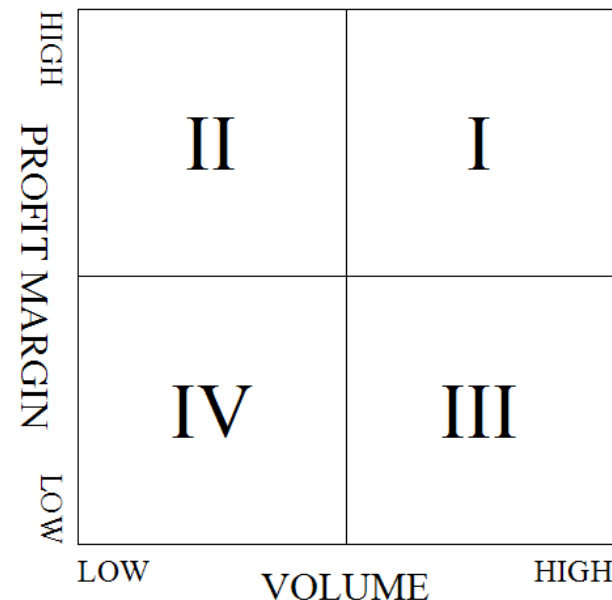
✓ Increase the **business** of these customers.

❖ High maintenance customers in this quadrant may require:

1. **More** of the **company's general overhead** or
2. **Require** so **much of management's time**.

❖ When this happens, management must:

1. **Increase** the **profitability** of the customers,
2. **Convert** them into **low-maintenance customers**, or
3. **Get rid of the customers** if they **cause losing customers in Quadrant I**.
 - ✓ The best way is to **pass** them along to **another contractor**.



Profit centers – Evaluating customers

❑ Customers in Quadrant III:

❖ Steady flow of work at a **low gross profit margin**.

✓ **Increase profit margin** by:

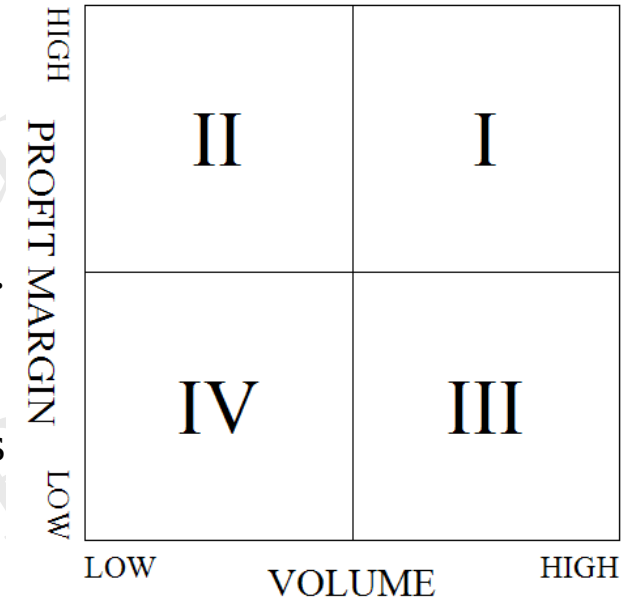
1. **Increasing the price or reducing the cost.**

However there is a **risk of losing job**.

2. Taking **fewer selective projects** from customers at a **higher gross profit margin**.

3. **Get rid of them**

○ Like the **Quadrant II customers**, if customers in this quadrant **distract the company's focus** from serving the **Quadrant I** customers or if they are **high-maintenance customers**, the company should consider **getting rid of them**.



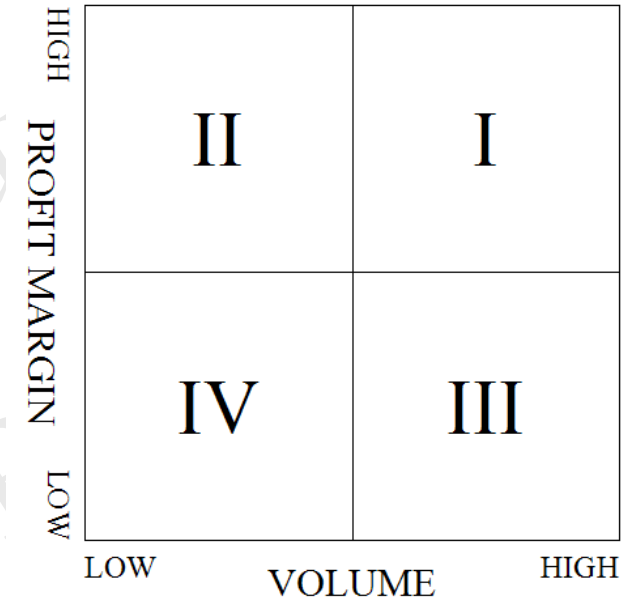
Profit centers – Evaluating customers

❑ Customers in Quadrant IV:

❖ Should be

1. **Moved** into one of the **other quadrants** or
2. **Dropped**

❖ **No company** can survive on **Quadrant IV**.



Profit centers – Evaluating customers

Elimination of a few customers who are **less profitable** or **too high maintenance** may allow management the **time** and **resources** to develop one customer into a customer that **produces more profit** than the eliminated customers.

It is **better** to be **small** and **highly profitable** than **large** and **marginally profitable**.

It is **not uncommon** for a **small company** to **double** and **triple** in **size** while seeing its **total profit** stay the same or shrink because it is taking on **less-profitable jobs** while **increasing general overhead costs**.

Profit centers – Evaluating equipment

- ❑ Each piece of equipment may be treated as a **profit center**.
- ❖ Revenues and costs of each piece of equipment should be known.
 - ✓ They are tracked within the **equipment ledger**.

Profit centers – Evaluating equipment

❑ Reasons to treat each piece of equipment as a **profit center**:

1. **Justify ownership or better off renting the equipment on a monthly, weekly, or daily balance**

- ❖ If looking at hiring a **subcontractor to provide the equipment**, we are looking at **replacing a crew** because they are **replacing** both **equipment** and **labor**.
- ✓ When **making this decision**, the **cost of owning the equipment** is compared to the **fair market value of renting the equipment**.
 - This decision is made for **each piece of equipment** and should be **made periodically**, for example, **annually**.

Economic analysis between lease, rent or buy

Profit centers – Evaluating equipment

❑ Reasons to treat each piece of equipment as a **profit center**:

2. Economical to repair old equipment or to replace

- ❖ This decision is made by **comparing** the historical costs of the company's equipment to the projected costs of the new equipment.
- ❖ Do not forget to consider **time value of money** when making these decisions.

Economic analysis between replace or retain

Profit centers – Evaluating equipment

❑ Reasons to treat each piece of equipment as a **profit center**:

3. Identify poor maintenance practices

❖ The **repairs and maintenance** category is subdivided into:

1. Repairs

✓ Used to **track unexpected repairs**

2. Maintenance

✓ **Routine maintenance** and **expected repairs** would be tracked in this category

✓ Such as **engine overhauls** that occur **every 200,000 miles**

3. Tires subcategories

Profit centers – Evaluating equipment

❑ Reasons to treat each piece of equipment as a **profit center**:

4. **Repair tire or foam fill the tires or replace the equipment with a tracked vehicle**

- ❖ The **tire cost** would be **tracked** in the **tires subcategory** under **repairs and maintenance**.

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

دفتر آموزش

تهران، بلوار فردوس شرق، مجتمع آبگینه، طبقه سوم اداری، واحد C42



+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۴۵



+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۵۰



info@dralavipour.com



www.dralavipour.com



@alavipour_pm



@acemi_social



@alavipour_pm



@IRANACEMI

