Project Management

CSE 4407

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The Spark: Origins of Systems Projects

- Project Triggers
  - Problems
  - Opportunities

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- Project Triggers
  - Problems: Things aren't working as they should. Performance gaps, inefficiencies, errors
  - Opportunities: Chance to improve, upgrade, or innovate. New tech, changing markets, e-commerce potential

Spotting Troubles: Signs of Underlying Problem

- Where to Look: How do we *detect* these problems?

Okay, We See Symptoms... Now What? Define the Problem!

- Why: It's the critical first step in any structured approach (like SDLC or O-O). Sets the foundation for the entire project

Uncovering the Real Issues: Analyst Detective Work

- How Analysts Identify Issues (During info gathering - interviews, observation, etc.)

Turning Problems into Goals: Setting Objectives

- Linking Issues and Objectives
  - Objectives should directly address the identified Issues (point-by-point if possible)

Case Study: Catherine's Catering Conundrum

- The Business: Small catering company (meals, receptions, banquets). Started small, good reputation led to growth

Demo: Problem Definition - Catherine's Catering

Catherine's Catering: Translating Objectives to User Requirements

- From Objectives to Action: User requirements specify *how* objectives will be met from a user perspective

Catherine's Catering: Thinking Ahead - Testing

- Why
  - Helps ensure requirements are *clear* and *testable*
  - Starts early, evolves over time

Not All Projects Are Created Equal: Selection Criteria

- Reality Check: Organizations have limited resources (time, money, people)

Project Go/No-Go: The Big Questions (1/2)

- Five Key Criteria for Selection

Project Go/No-Go: Practicality and Worth (2/2)

- Five Key Criteria for Selection
  4. Practical in Terms of Resources?
     - Do *we* (analysts/dev team) have the necessary skills and tools?
     - Does the *organization* have the capacity (staff, infrastructure)?
     - Recognize limitations – some projects might require external expertise

Selected the Project... But Is It Doable?

- Recap: We have narrowed down potential projects based on strategic fit, backing, timing, etc.

Can We *Really* Do This? The T.E.O. Test

- **T**echnical Feasibility: Do we have the tech and skills?
- **E**conomic Feasibility: Does it make financial sense?
- **O**perational Feasibility: Will people actually use it effectively?

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  - Systems analysts' time
  - Cost of systems study
  - Cost of employees' time for study
  - Estimated cost of hardware
  - Cost of packaged software or software development
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- **O**perational Feasibility: Will people actually use it effectively?
  - Whether the system will operate when put in service
  - Whether the system will be used

Feasibility Deep Dive: Technical Check

- Key Questions

Feasibility Deep Dive: Economic Check

- Key Questions

Feasibility Deep Dive: Operational Check

- Assumes: Tech is possible, Economics make sense

Supporting Feasibility: Estimating Workloads

- Why?
  - Essential for assessing Technical (Hardware needs) and Economic (Processing costs) feasibility
  - Ensures new hardware can handle *current* AND *future* demands (avoids costly early replacement due to growth)

Feasibility Passed! Now, What Gear Do We Need?

- Next Step: Dive deeper into the specifics of Hardware and Software requirements
  - Builds upon Technical Feasibility assessment
  - Involves inventory, estimation, and evaluation

Taking Stock: The Hardware Inventory

- Why?
  - Can’t make good decisions without knowing the starting point
  - Identifies usable existing hardware (potential for reuse/upgrades)
  - Reduces guesswork

Choosing the Right Tools: Evaluating Hardware

- Shared Responsibility: Management, Users, and Systems Analysts
  - Analyst oversees objectively
  - Analyst educates others on pros/cons

Own It or Rent It? Buy vs. Cloud Hardware

- Paths for Acquiring Hardware Infrastructure
  - Buy
  - Cloud

Cloud Flavors: SaaS, PaaS, IaaS

- Beyond just Hardware
  - Infrastructure as a Service (IaaS)
  - Platform as a Service (PaaS)
  - Software as a Service (SaaS)

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  - Software as a Service (SaaS) $\rightarrow$ Like renting a fully furnished apartment
    - Renting ready-to-use software applications over the internet (e.g., Google Workspace, Salesforce, Office 365)
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Beyond the Box: Evaluating Vendor Support

- Key Areas to Evaluate: What happens *after* the sale?

Trend Watch: Bring Your Own Device (BYOD)

- What: Employees using their *personal* devices for work

Now for Software: Build, Buy, or Rent?

- Paths for Acquiring Software
  - Create Custom Software
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  - Use SaaS Provider: Subscribe to software delivered over the cloud (e.g., Salesforce, Google Workspace)
- Summary Trade-offs

Option	Advantages	Disadvantages
Custom Software	Customization, Innovation, In-house support, Ownership	High cost, Dev team, Maintenance

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COTS Software	Low cost, Functionality, Reliability, Proven, Documentation	Generic, Rigid, Vendor risk, Common, Integration
SaaS Provider	No IT, Focus, Quick setup, Scalability, Auto-updates	Less control, Security, Provider risk, Lock-in, Missing features

Judging Software Quality and Support

- Objective Evaluation: Don't rely solely on vendor claims your demos! Use *your* data, involve users

Weighing the Scales: Costs vs. Benefits

- The Deciding Factor
  - While meeting requirements is key, the final ‘Go/No-Go’ often hinges on **Cost-Benefit Analysis**
  - Does the value justify the expense?

Predicting the Future (Sort Of): Forecasting Basics

- Why: Needed for credible cost-benefit analysis over the system's life

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  - Intangible Benefits

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  - Tangible Benefits: Measurable in dollars
    - Increased processing speed $\rightarrow$ Reduced labor time
    - Access to new information $\rightarrow$ Better decisions leading to profit/savings
    - Timelier information $\rightarrow$ Faster response to opportunities/threats
    - Superior calculation power $\rightarrow$ Complex analysis possible
    - Decreased employee time on tasks $\rightarrow$ Labor cost savings
    - Reduced errors $\rightarrow$ Lower correction costs
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  - Intangible Benefits: Difficult to quantify, but still important!
    - Improved decision-making process
    - Enhanced data accuracy
    - Improved customer service
    - Reputation
    - Increased employee job satisfaction

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    - Operational costs (maintenance contracts, cloud subscription fees, electricity)
  - Intangible Costs: Difficult to estimate, but represent real risks
    - Losing competitive edge $\rightarrow$ If the system fails or is delayed
    - Damaged company image $\rightarrow$ Due to system errors/outages
    - Reduce employee morale $\rightarrow$ Due to difficulty/frustrating system
    - Ineffective decisions $\rightarrow$ Due to system providing poor/untimely information

Technique 1: Break-Even Analysis

- Purpose: Determines the point where a new system becomes more *cost-effective* than the current system based on volume

Technique 2: Payback Analysis (and Break-Even Limits)

- Break-Even Analysis Limitations
  - Primarily focuses on *costs*, assuming benefits remain constant (often not true!)
  - Doesn't explicitly show *when* the initial investment is recouped

From Big Idea to Done Deal: Managing Time and Activities

- Challenge: Systems projects, especially large ones, can get complex and unwieldy

Divide and Conquer: The Work Breakdown Structure (WBS)

- What: A hierarchical decomposition of the total scope of work to be carried out by the project team

Ways to Structure the WBS

- Two Common Approaches
  - Product-Oriented WBS
  - Process-Oriented WBS

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    - Breaks down the work based on the *components* of the final product
    - Example: Website $\rightarrow$ Home Page, Product Pages, FAQ Page, Contact Page, E-commerce Module
    - Each component has sub-tasks
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    - Each component has sub-tasks
  - Process-Oriented WBS
    - Breaks down the work based on the *phases* or *processes* involved (e.g., SDLC phases)
    - Example: Website → Emphasizes on what to do in Initiation, Planning, Analysis, Design, and Launch

Demo: Sample Process Oriented WBS

How Long Will It *Really* Take?

- Goal: Arrive at realistic estimates for each task in the WBS

Estimation Techniques: Drawing From The Past

- **Relying on Experience**
  - Best approach if you have done the same tasks before
  - Providers estimates based on real-world knowledge (including potential pitfalls)
  - Gives “most likely” and “pessimistic” estimates

Estimation Techniques: Three-Point Method

- Concept
  - Combines optimistic, pessimistic, and most likely estimates to get a weighted average
  - Accounts for uncertainty

Estimation Techniques: Specialized

- **Function Point Analysis (FPA)**
  - Estimates effort based on the system's *functional size* and complexity, NOT lines of code initially
  - Measures five components: External Inputs, External Outputs, External Queries, Internal Logical Files, External Interface Files
  - Complexity ratings are applied
  - Can be used to compare estimated effort across different Programming languages
  - Resource: International Function Point Users Group (IFPUG)

Scheduling the Work: Planning and Control

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- Control: Monitoring progress against the plan, using feedback, taking corrective action (expediting, rescheduling), motivating the team
- Foundation: A detailed WBS

Phase	Activity
Analysis	Data gathering Data flow and decision analysis Proposal preparation
Design	Data entry design Input design Output design Data organization
Implementation	Implementation Evaluation

Scheduling the Work: Planning and Control

- Planning: Selecting the team, assigning tasks, estimating time, *creating the schedule*
- Control: Monitoring progress against the plan, using feedback, taking corrective action (expediting, rescheduling), motivating the team
- Foundation: A detailed WBS
- Key
  - Detail must be sufficient for scheduling and control
  - Time estimates are added

Phase	Activity	Detailed Activity	Wk.
Analysis	Data gathering	Conduct interviews	3
		Administer questionnaires	4
		Read company reports	4
		Introduce prototype	5
		Observe reactions to prototype	3
	Data flow and decision analysis	Analyze data flow	8
	Proposal preparation	Perform cost-benefit analysis	3
		Prepare proposal	2
		Present proposal	2
Design	Data entry design	-	-
	Input design	-	-
	Output design	-	-
	Data organization	-	-
Implementation	Implementation	-	-
	Evaluation	-	-

Visualizing the Time: Gantt Charts

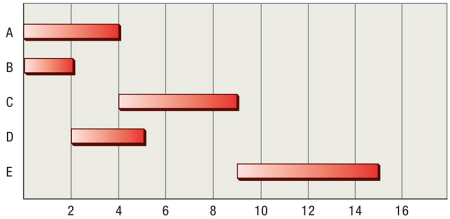
- What: A horizontal bar chart showing project tasks against a timeline

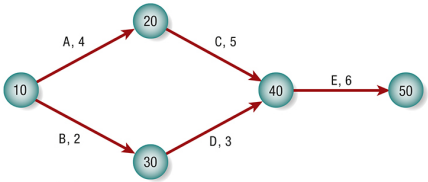
Gantt Chart Limits and A More Powerful Tool: PERT

- Gantt Chart Weakness Doesn't clearly show **dependencies** or **precedence**
  - Can't easily tell *why* a task starts after another one finishes. Is it required, or just coincidence?
  - Doesn't highlight which tasks are *critical* to the overall project duration

Visualizing Dependencies: Gantt vs. PERT

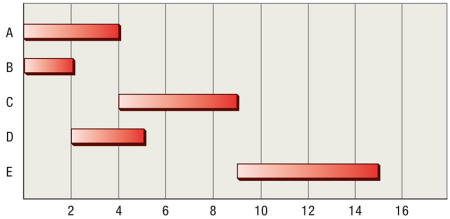
- Gantt Chart: Represents the tasks as bars against time
- PERT Diagram: Represents the same tasks as a network

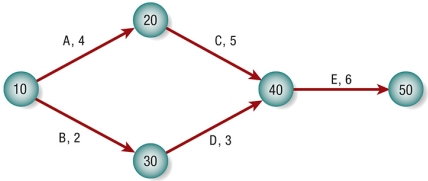




PERT Concepts: Critical Path

- Path: A sequence of connected activities from the start event to the end event
- Path Length: Sum of the durations of all activities on a path





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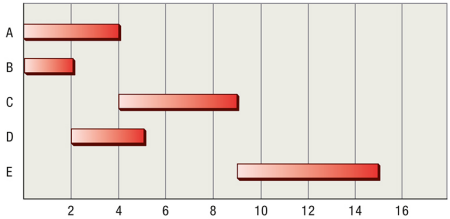
- Critical Path: The **longest path** through the PERT network
  - Determines the **shortest possible completion time** for the entire project
  - **Any delay** on a critical path activity directly delays the project completion date
- Example
  - Path 1 (A-C-E): 10 → 20 → 40 → 50 (15 weeks)
  - Path 2 (B-D-E): 10 → 30 → 40 → 50 (11 weeks)



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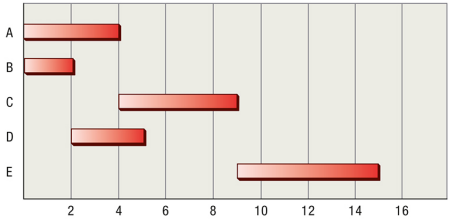
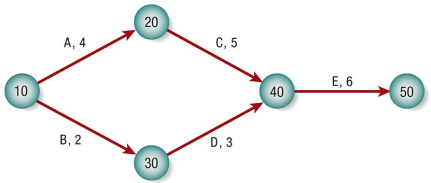
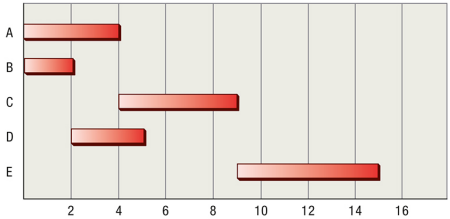
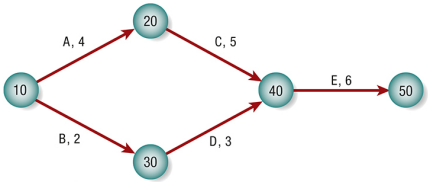




PERT Concepts: Slack Time

- The amount of time a task or path can be delayed *without* delaying the entire project
- Exists only on non-critical paths





PERT Concept: Dummy Activities

- What: Activities with ZERO duration, usually shown as dashed lines

PERT Example: Data Gathering and Proposal

- Scenario: Scheduling the initial phases of a systems project

Activity		Predecessor(s)	Duration (Weeks)
A	Conduct interviews	None	3
B	Administer questionnaires	A	4
C	Read company reports	None	4
D	Analyze data flow	B, C	8
E	Introduce prototype	B, C	5
F	Observe reactions prototype	E	3
G	Perform cost-benefit	D	3
H	Prepare proposal	F, G	2
I	Present proposal	H	2

PERT Example: Constructing the Network

- Process: Start with activities having no predecessors. Add activities sequentially based on their listed predecessors. Ensure all dependencies are represented.

10

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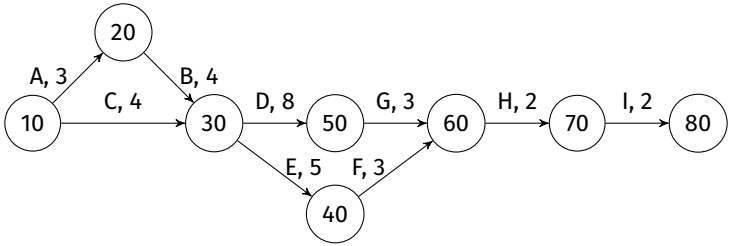
PERT Example: Identifying the Critical Path

- Method: Calculate the total duration of *every possible path* from start (10) to end (80). The longest one is critical.



Staying on Track: Controlling the Project

- Reality Check: Things go wrong! Scope changes, delays happen, costs fluctuate

Controlling Costs: Estimation

- Builds on WBS and Schedule: Need cost estimates for each activity

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- Main Resource Cost: Project team time! (Also special equipment/tools)
- Cost Estimation Approaches: Similar to Time Estimation
  - Top-Down
    - Base estimates on similar past projects (experience driven)
    - Adjust for known differences
  - Bottom-Up
  - Parametric Modeling

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    - Get estimates from team members responsible for each WBS task
    - Analyst reviews/aggregates
    - Can be time-consuming, variable
  - Parametric Modeling
    - Use parameters/formulas (e.g., cost per line of code, cost per hour) + Project size estimates
    - Software like COCOMO II can assist

Controlling Costs: Pitfalls and Budgeting

- Why Cost Estimates Often Fail
  - Over-Optimism
  - Rushing

Demo: Sample Budget

Controlling Costs: Pitfalls and Budgeting

- Why Cost Estimates Often Fail
  - Over-Optimism
    - Believing everything will go perfectly
    - Underestimating effort/complexity (e.g., lines of code)
    - “Happy path” estimating
  - Rushing

Demo: Sample Budget

Managing Risk: Looking Out for Trouble

- Best Defense: Thorough initial analysis, feasibility studies, understanding motivations, experience!

Need for Speed? Expediting Activities

- Crashing: Speeding up project activities to finish earlier
- Why
  - Potential bonus for early completion
  - Free up resources/team members for other projects sooner
  - Recover from earlier delays

Need for Speed? Expediting Activities

- Crashing: Speeding up project activities to finish earlier
  - Crash Time: Absolute minimum time an activity *can* take
  - Cost/Week: The additional cost incurred to reduce the activity duration by one week
- Why
  - Potential bonus for early completion
  - Free up resources/team members for other projects sooner
  - Recover from earlier delays

How to Expedite: The Analysis

- Rule #1: Only expedite critical-path activities
- Rule #2: Pick the cheapest critical-path activity per time saved
- Rule #3: Never expedite an activity below its minimum (crash) duration

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A, B, D, G, H, or I							

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How to Expedite: The Analysis

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- Rule #2: Pick the cheapest critical-path activity per time saved
- Rule #3: Never expedite an activity below its minimum (crash) duration

Eligible Activities	Activity Chosen	Time for Each Path				Cost	Cu. Cost
		(22)	19	19	16		
A, B, D, or I	B	(21)	18	19	16	$500	$500
A, B, D, or I	B	(20)	17	19	16	500	1,000
A, B, D, or I							

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A or D	A	(18)	16	(18)	15	800	2,400
A and C, or D	D	(17)	16	17	15	1,000	3,400
A and C, or D	D	(16)	(16)	(16)	15	1,000	4,400
A and C, or D							

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A and C							

Comprehensive Control: Earned Value Management (EVM)

- Purpose: Integrates project **scope** (work done), **schedule** (time), and **cost** ($$$) into a unified framework to measure performance and predict outcomes

EVM in Action: Website Example

Project Budget: $18,000

At the End of	Stage	Estimated Cost	Cu. Estimate	Estimated Duration	Stage Completed	Actual Cost of Stage to Date	Actual Cost of Project to Date
Month 1	1	$6,000	$6,000	1 month	100%	$6,000	$6,000
Month 2	2	3,000	9,000	1 month	100%	3,000	9,000
Month 3	3	3,000	12,000	1 month	100%	3,000	12,000
Month 4	4	3,000	15,000	1 month	50%	5,000	17,000
Month 5	5	3,000	18,000	1 month	0%	Not yet begun	Not yet begun

- EVM at End of Month 4
  - $BAC = \$18,000$
  - $PV = \$15,000$ (Cumulative Estimated Cost)
  - $AC = \$17,000$
  - EV =? (Needs to be calculated)

EVM Calculations: Where Do We Stand?

After 4 months,

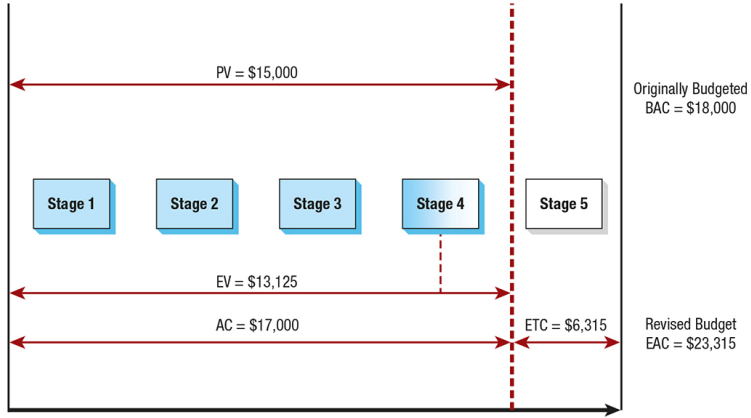
- Calculate % Work done so far (p): $\frac{100\%+100\%+100\%+50\%}{100\%+100\%+100\%+100\%} = \frac{350}{400} = 0.875$

EVM Forecasting: Where Are We Headed?

- Purpose: Use CPI to predict future costs

EVM Visualization: Key Takeaway

- Analyst's Role: Balance Cost, Time, and Scope based on this information



It's About People: Managing the Project Team

- Equally Important: Managing the people doing the work

Who's On the Team? Assembling the Right Mix

- Core Values: Look for shared values (teamwork, quality, on-time/on-budget delivery)

The Right Skills for the Job: Team Composition

- Essential Roles/Skills
  - Business Knowledge: At least one person who deeply understands the business area/domain (e.g., Marketing expert for e-commerce site)

Making the Team Tick: Communication and Dynamics

- Team Personality: Each team develops a unique interaction style

Unwritten Rules: Understanding Team Norms

- What: Collective expectations, values, and standard ways of behaving within a *specific* team (Can be explicit or implicit)

Aiming High: Setting Goals and Motivating the Team

- Setting Productivity Goals
  - Based on team expertise, past performance, project nature
  - Goals should be challenging, but achievable
  - Team participation in goal-setting increases buy-in

Unique Challenges: Managing E-commerce Projects

- Key Differences
  - Scattered Data
    - Cross-department (Marking, Sales, Inventory, Finance)
    - Increases complexity and dept. politics

Getting It In Writing: The Project Charter

- Purpose
  - A written document clarifying project scope, objectives, and expectations
  - Acts as a contract between the team, users, and management

The Grand Finale (of Analysis): The Systems Proposal

- What: A formal written document detailing
  - systems study
  - findings
  - alternatives, and
  - **recommendations**

What Goes Inside? The 10 Proposal Sections

- Standard Structure: Preliminary Materials
  1. Cover Letter
     - Friendly intro
     - Study objectives
     - Team members

What Goes Inside? The 10 Proposal Sections

- Standard Structure: Study and Analysis
  5. Outlines of Systems Study
     - Methods used (interviews, surveys, observation, etc.)
     - Who/what was studied

What Goes Inside? The 10 Proposal Sections

- Standard Structure: Conclusion and Support
  9. Proposal Summary
     - Brief recap mirroring Executive Summary (objectives, recommendation, importance)
     - Positive conclusion

Getting the Word Out: Delivery and Presentation

- Distribution
  - Carefully select recipients (key decision-makers)
  - Hand-deliver copies if possible (increases visibility)

A Picture is Worth... Supporting Your Words with Figures

- Why?
  - People absorb information differently; visuals help
  - Demonstrate responsiveness to audience needs
  - Capture and communicate complex data effectively

Organizing Data: Effective Use of Tables

- Purpose: Present statistical or alphabetical data in an organized, structured way

Visualizing Trends and Comparisons: Effective Graphs

- Purpose: Illustrate comparisons (Line, Column, Bar) or composition (Pie, Area)

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