INSE 6230
Total Quality Project Management

Project Quality Management
Project Procurement Management

Project Quality Management

What Is Quality?

- Definitions based on:
  - **Ability to satisfy the needs**
    - The totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs *(ISO - International Organization for Standardization)*
  - **Conformance to requirements**
    - The project's processes and products meet written specifications
  - **Fitness for use**
    - A product can be used as it was intended

Project Quality Management

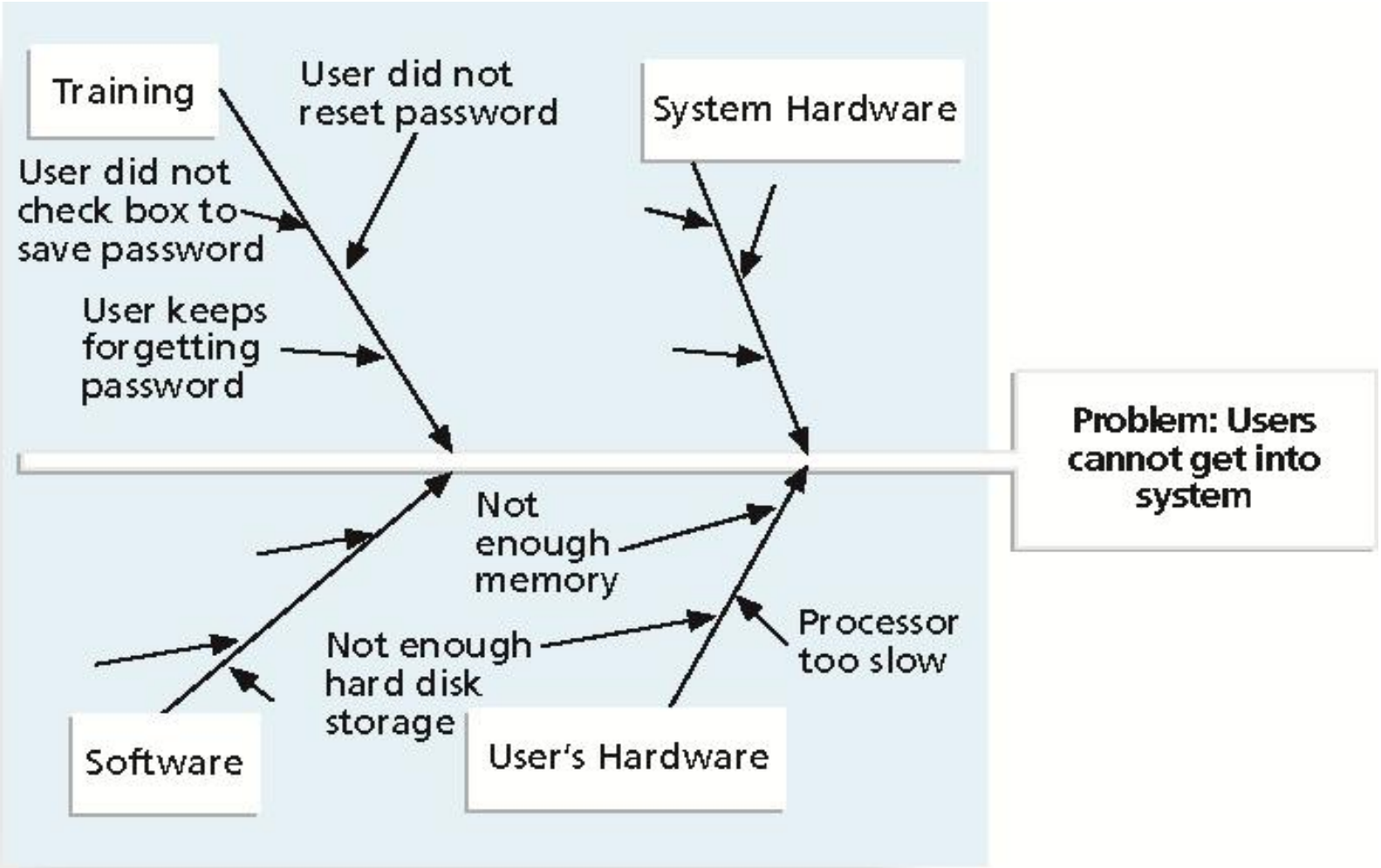
- **Project quality management** ensures that the project will satisfy the needs for which it was undertaken
- Processes include:
  - **Planning quality**
    - Identifying which quality standards are relevant to the project and how to satisfy them
  - **Performing quality assurance**
    - Periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards
  - **Performing quality control**
    - Monitoring specific project results to ensure that they comply with the relevant quality standards

1. Cause-and-Effect Diagrams

- **Cause-and-effect diagrams** trace complaints about quality problems back to the responsible production operations
- They help you find the **root cause of a problem**
- Also known as **fishbone** or **Ishikawa diagrams**
- Can also use the **5 whys technique** where you repeatedly ask the question “Why” (five is a good rule of thumb) to peel away the layers of symptoms that can lead to the root cause

Cause-and-Effect Diagram

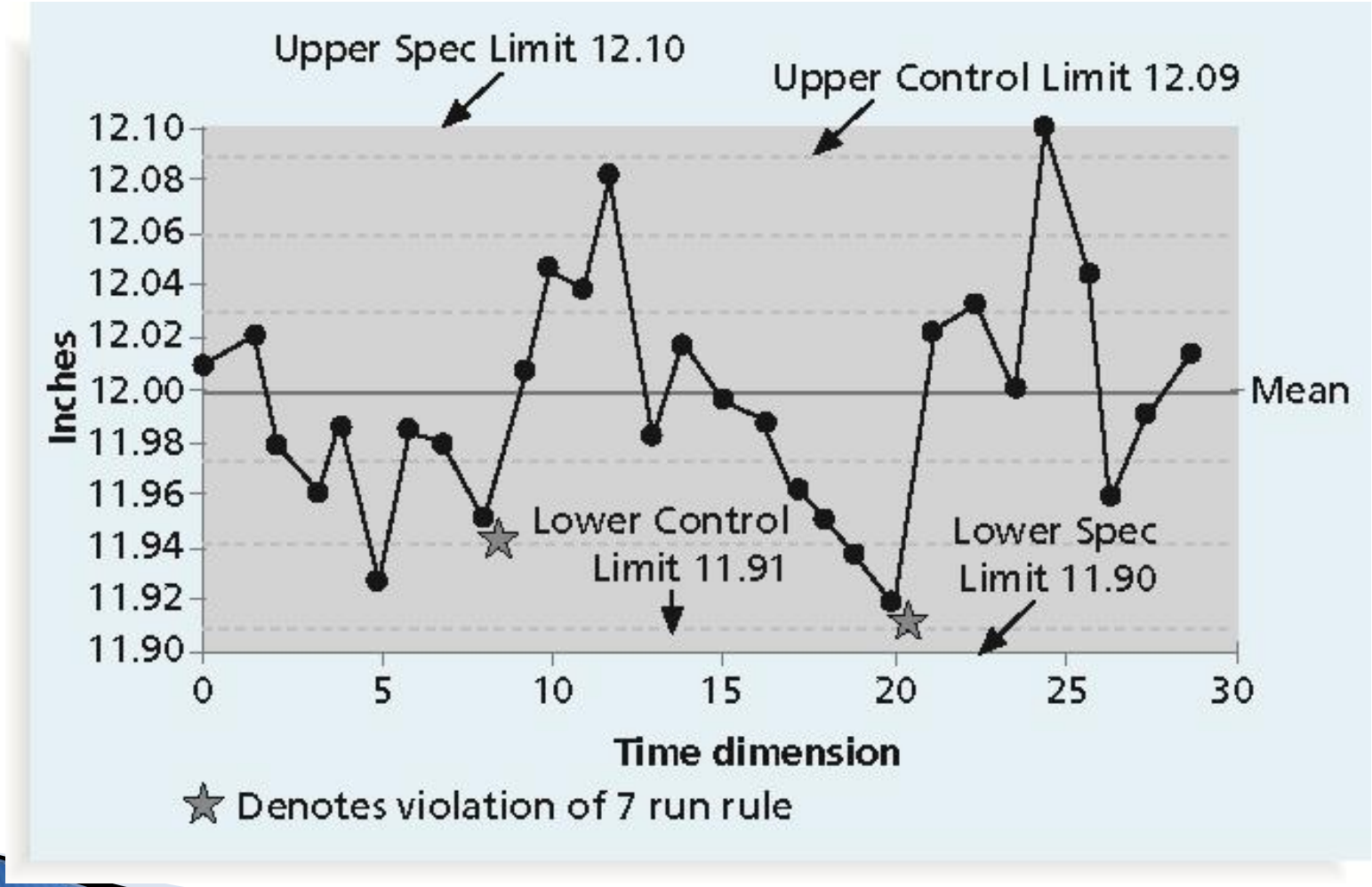
Example



2. Quality Control Charts

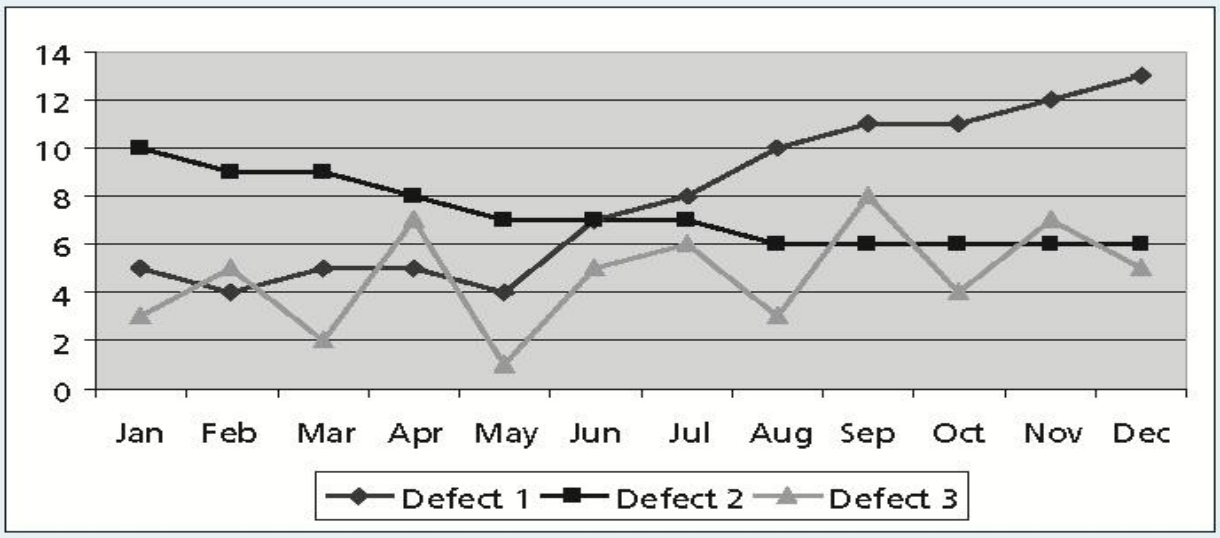
- A **control chart** is a graphic display of data that illustrates the results of a process over time
  - To determine whether a process is in control or out of control
    - When a process is **in control**, any variations in the results of the process are created by random events; processes that are in control do not need to be adjusted
    - When a process is **out of control**, variations in the results of the process are caused by non-random events; you need to identify the causes of those non-random events and adjust the process to correct or eliminate them
  - To look for patterns in data
    - The **seven run rule** states that if seven data points in a row are all below the mean, above the mean, or are all increasing or decreasing, then the process needs to be examined for non-random problems

Quality Control Chart
Example



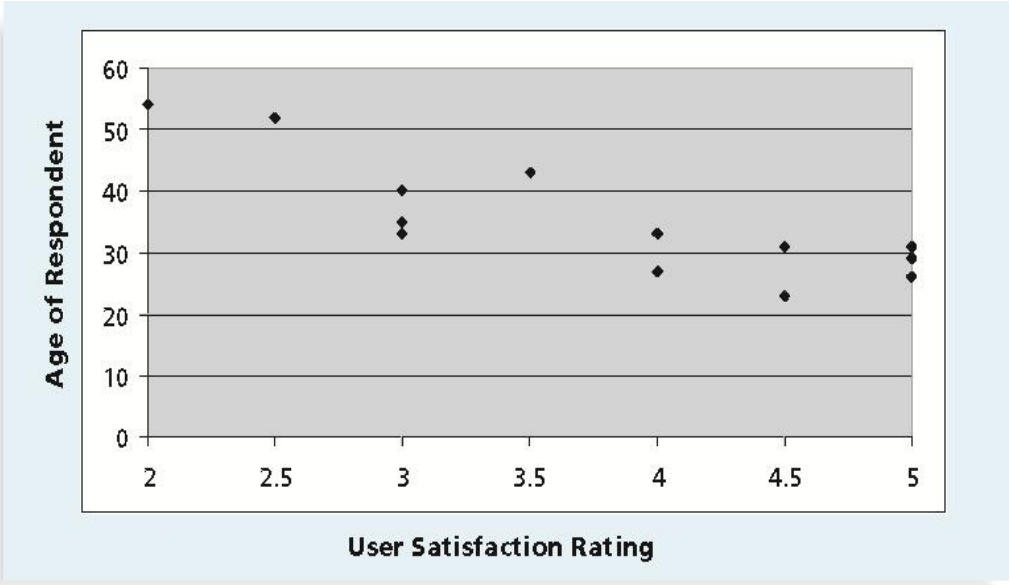
3. Run Chart

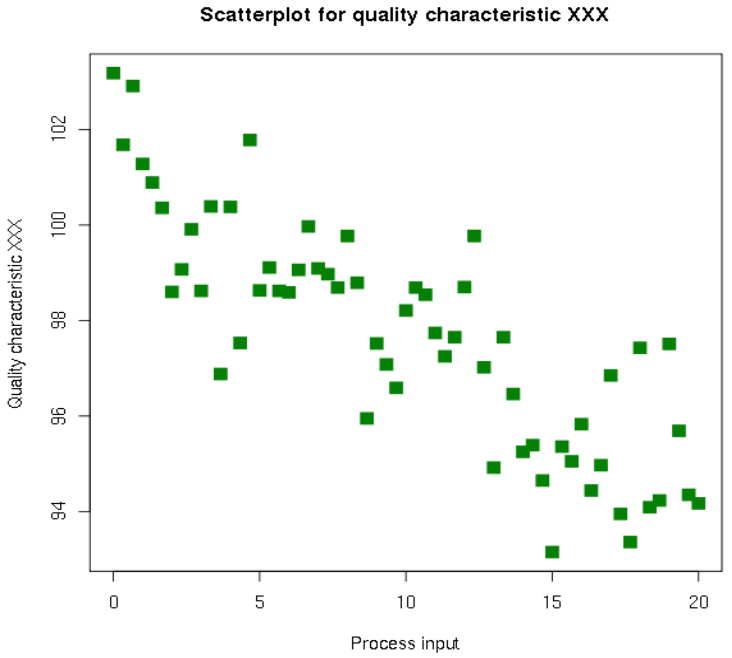
- **A run chart** displays the history and pattern of variation of a process over time
- Displays data in a time sequence
- Can be used to perform trend analysis to forecast future outcomes based on historical patterns
- For example we can determine:
  - How many defects have been identified over time
  - Whether there are any trends in the defects



4. Scatter Diagram

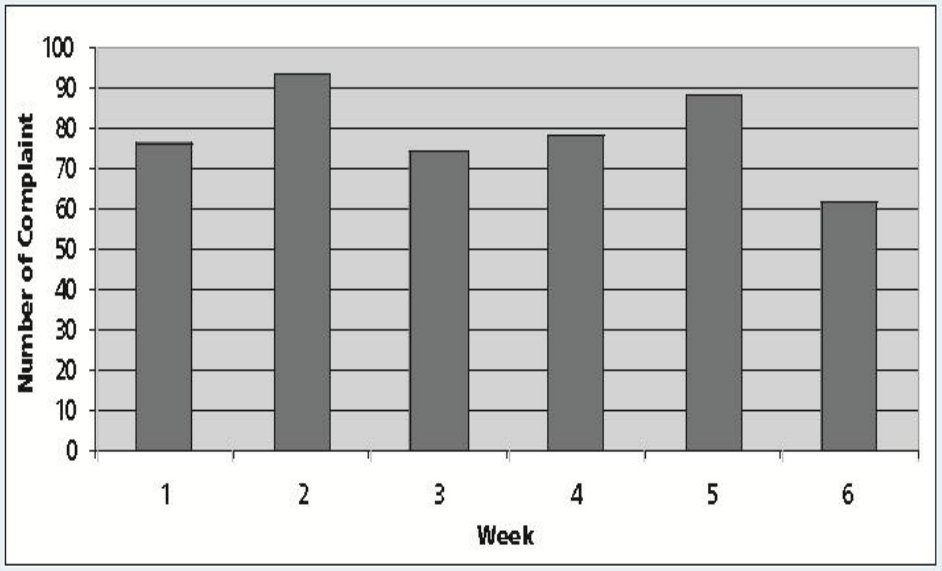
- A **scatter diagram** helps to show if there is a relationship between two variables
- The closer data points are to a diagonal line, the more closely the two variables are related

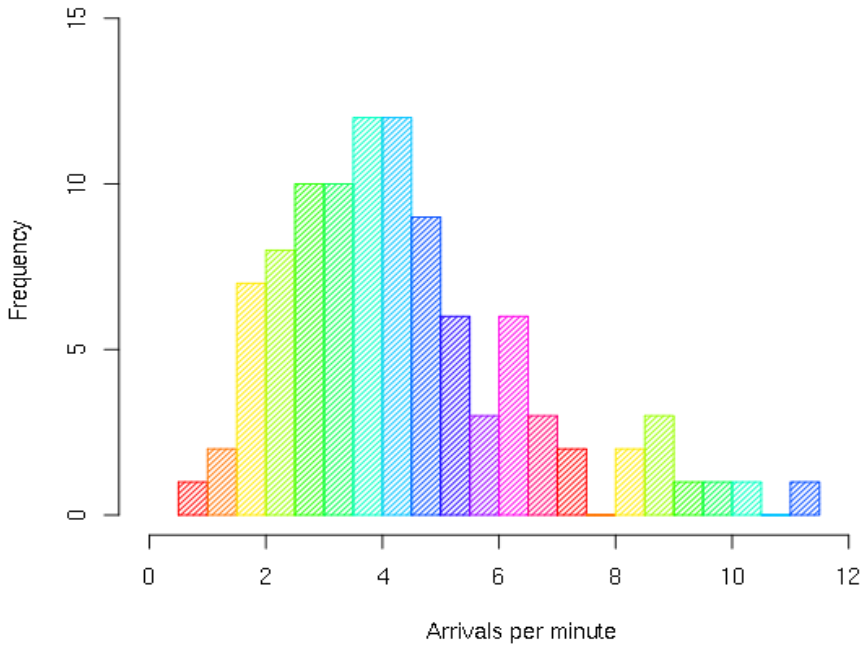




5. Histograms

- A **histogram** is a bar graph of a distribution of variables
- Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency

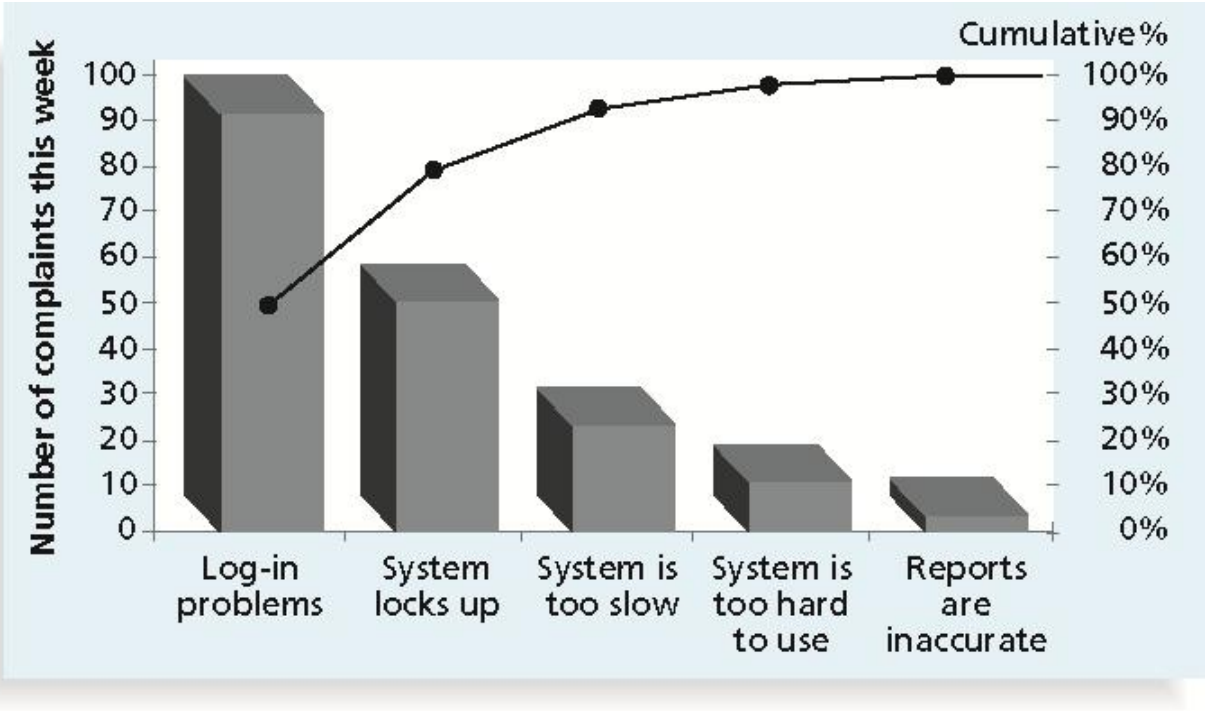




6. Pareto Charts

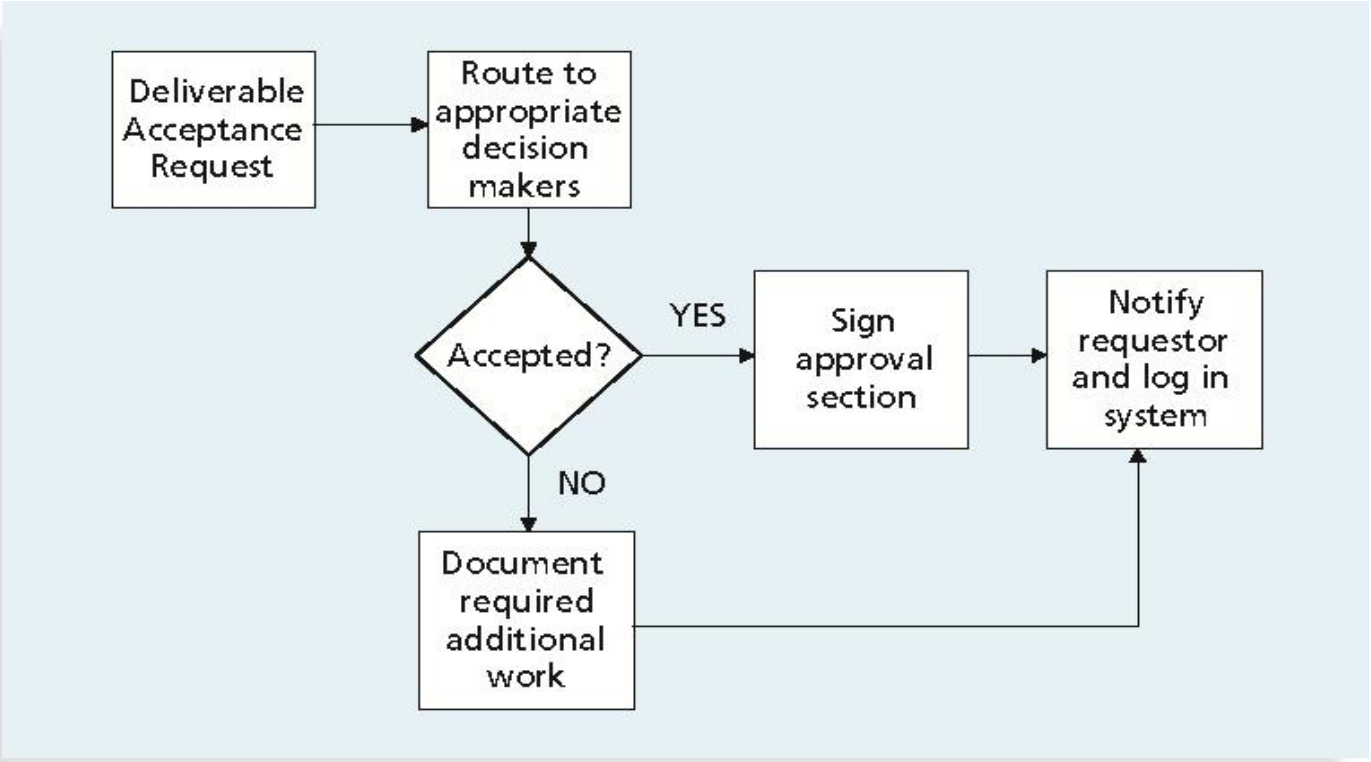
- A **Pareto chart** is a histogram that can help you identify and prioritize problem areas

- **Pareto analysis** is also called the 80-20 rule, meaning that 80 % of problems are often due to 20 % of the causes



7. Flowcharts

- **Flowcharts** are graphic displays of the logic and flow of processes that help you analyze how problems occur and how processes can be improved
- They show activities, decision points, and the order of how information is processed



Chapter Summary

- Project quality management ensures that the project will satisfy the needs for which it was undertaken
- Main processes include:
  - Plan quality
  - Perform quality assurance
  - Perform quality control

Project Procurement Management

Project Procurement Management

- Procurement means acquiring goods and/or services from an outside source
  - Other terms include purchasing and outsourcing
    - Offshoring is outsourcing to other countries
  - Most organizations do some form of outsourcing to meet their needs
- **Why outsource?**
  - Reduce costs
  - Focus on its core business
  - Access skills and technologies
  - Provide flexibility
  - Increase accountability
- **Why not?**
  - Less control
  - Dependency on key suppliers
  - Protection of strategic information

Project Procurement Management Processes

- Project procurement management: acquiring goods and services for a project from outside the performing organization
- Processes include:
  - *Planning procurements*: determining what to procure, when, and how
  - *Conducting procurements:* obtaining seller responses, selecting sellers, and awarding contracts
  - *Administering procurements:* managing relationships with sellers, monitoring contract performance, and making changes as needed
  - *Closing procurements:* completing and settling each contract, including resolving of any open items

Planning Procurements

- Identifying which project needs can be best met by using products or services outside the organization
  - whether to procure
  - how to procure
  - what to procure
  - how much to procure
  - when to procure
- If there is no need to buy any products or services from outside the organization, then there is no need to perform any of the other procurement management processes!
- Tools and techniques:
  - **Expert judgment:**
    - Both internal and external experts can provide valuable inputs in procurement decisions
  - **Make-or-buy analysis**:
    - Used to determine whether an organization should make or perform a particular product or service inside the organization or buy from someone else

Planning Procurements

- **Procurement Management Plan** describes how the procurement processes will be managed, from developing documentation for making outside purchases or acquisitions to contract closure
- **A statement of Work (SOW)** is a description of the work required for the procurement
  - A good SOW gives bidders a better understanding of the buyer's expectations
- **Request for Proposals (RFP)**: a document used to solicit proposals from prospective sellers
    - A **proposal** is a document prepared by a seller when there are different approaches for meeting buyer needs
      - Selection based on *various criteria*
- **Request for Quotes (RFQ)**: a document used to solicit quotes or bids from prospective suppliers
    - **A bid,** also called **a tender** or **quote** (short for quotation), is a document prepared by sellers providing pricing for standard items that have been clearly defined by the buyer
      – Selection based on *the lowest bid*

Conducting Procurements

- Deciding whom to ask to do the work
- Sending appropriate documentation to potential sellers
  - Approaching the preferred vendor
  - Approaching several potential vendors
  - Advertising to anyone interested
- Obtaining proposals or bids
- Selecting a seller (called also source selection)
- Awarding a contract

Types of Contracts

- Different types of contracts for different situations:
  - **Fixed price** contracts (or lump sum contracts): involve a fixed total price for a well-defined product or service
  - **Cost reimbursable** contracts: involve payment to the seller for direct and indirect costs
  - **Time and material** contracts: hybrid of both fixed price and cost reimbursable contracts, often used by consultants
- A single contract may actually include all three of these categories

Fixed Price Contracts

- In fixed price contracts the contractor is paid a negotiated amount regardless of incurred expenses.
- **Firm Fixed Price (FFP) contract**
  - Requires delivery of a product or services at a specified price, fixed at the time of contract award and *not subject to any adjustment.*
  - Places 100% responsibility and risk on the contractor.
  - Encourages contractor efficiency and economy.
- **Fixed Price Incentive (FPI) contract**
- A fixed-price type contract with provisions for adjustment
- The final contract price is based on a comparison between the final negotiated total costs (actual costs = AC) and the total target costs.
- The final price is subject to a *price ceiling*, negotiated at the outset.
- Provides incentive for efficiency and economy

Fixed Price Incentive (FPI) Contracts

- Elements of FPI contract:
  - ***Target cost:*** A reasonable estimate of the anticipated total cost of performance (allowable expected cost). It is established prior to performance
  - ***Target profit:*** A reasonable return on the anticipated cost of performance as agreed by the parties prior to performance (fixed fee to the supplier). It is not (necessarily) the final profit
  - ***Target price:*** Target cost + target profit
  - ***Ceiling price:*** The maximum dollar value the buyer is willing and obligated to pay for the goods or services, regardless of costs overruns.
  - ***Share ratio:*** Benefit/cost sharing ratio between the buyer and seller. *E.g.,* the ratio of 80%-20% means that the buyer shares 80% of the overruns (costs) and 80% of the underruns (savings). However, a typical set of share ratios are 80/20 for overruns and 50/50 for underruns. This means the seller pays 20% of any cost overruns up to the ceiling but receives 50% of any cost savings (underruns). In such case the seller is incentivised to achieve underruns but not heavily penalised for cost overruns.

Fixed Price Incentive (FPI) Contracts

- The **Point of Total Assumption (PTA)** is a point at which the contractor assumes total responsibility of each additional dollar of contract cost, *i.e.* bears all the costs of a cost overrun
  - Identifies the mathematical point at which the contractor's risk changes from the negotiated incentive sharing to a fixed price risk - 100% responsibility for cost incurred.
- PTA is unique to FPI contracts (cost overruns)
- PTA corresponds to min AC at which the buyer will pay ceiling price
- Responsibility for cost overruns:
  - **Up to the target cost, the buyer pays 100% of the costs.** (not overrun)
  - **Between the target cost, and the PTA, additional costs are shared between the buyer and the seller based on the Share Ratio.**
  - **Above the PTA, the seller (contractor) pays 100% of the additional costs**
- In addition to the buyer's share of the costs, the buyer will also pay the seller's fee or profit.

$$PTA = \frac{ceiling\ price - target\ price}{buyer's\ Share\ Ratio} + target\ cost$$

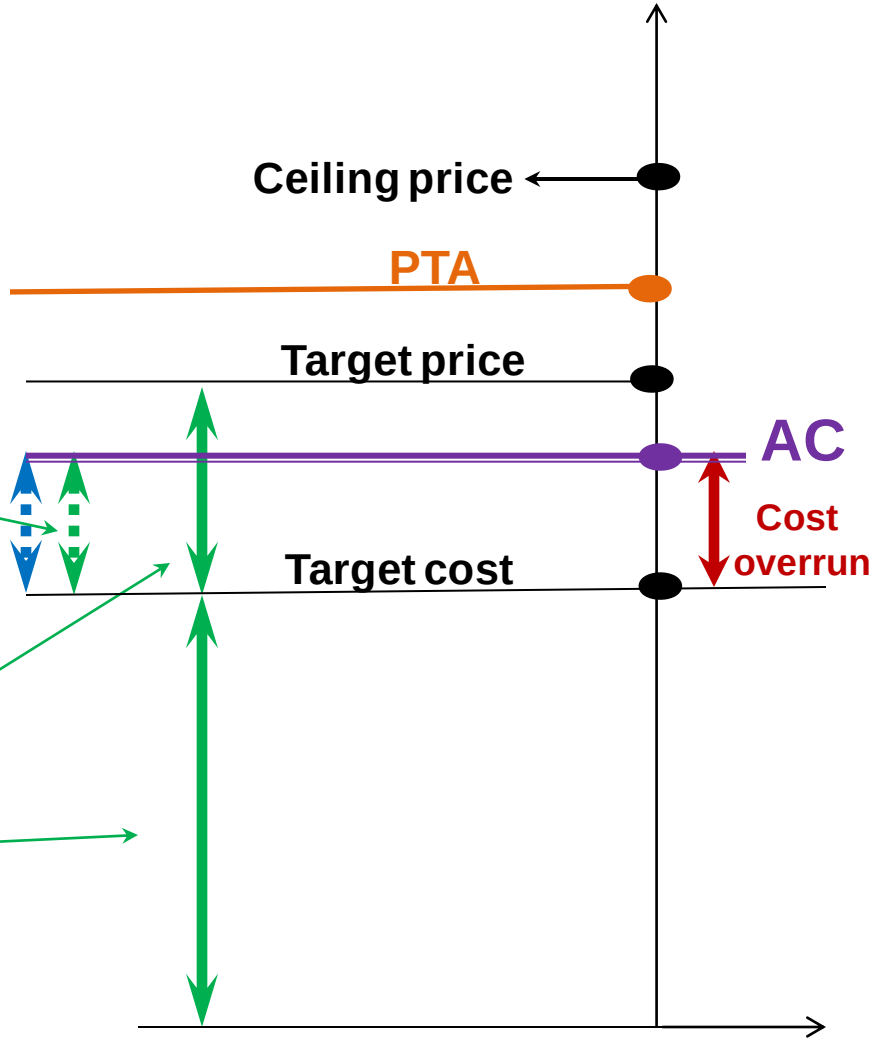
Fixed Price Incentive (FPI) Contracts
- The case of cost overrun (Target cost < AC < PTA)

Responsibility for the costs incurred:

- ***Seller (contractor, supplier) pays:***
  Seller's share of (AC - target cost)

- ***Buyer (government) pays:***
  Buyer's share of (AC - target cost)

- ***Moreover, buyer also pays:***
  Seller's profit (contractor's fee)
  Target cost

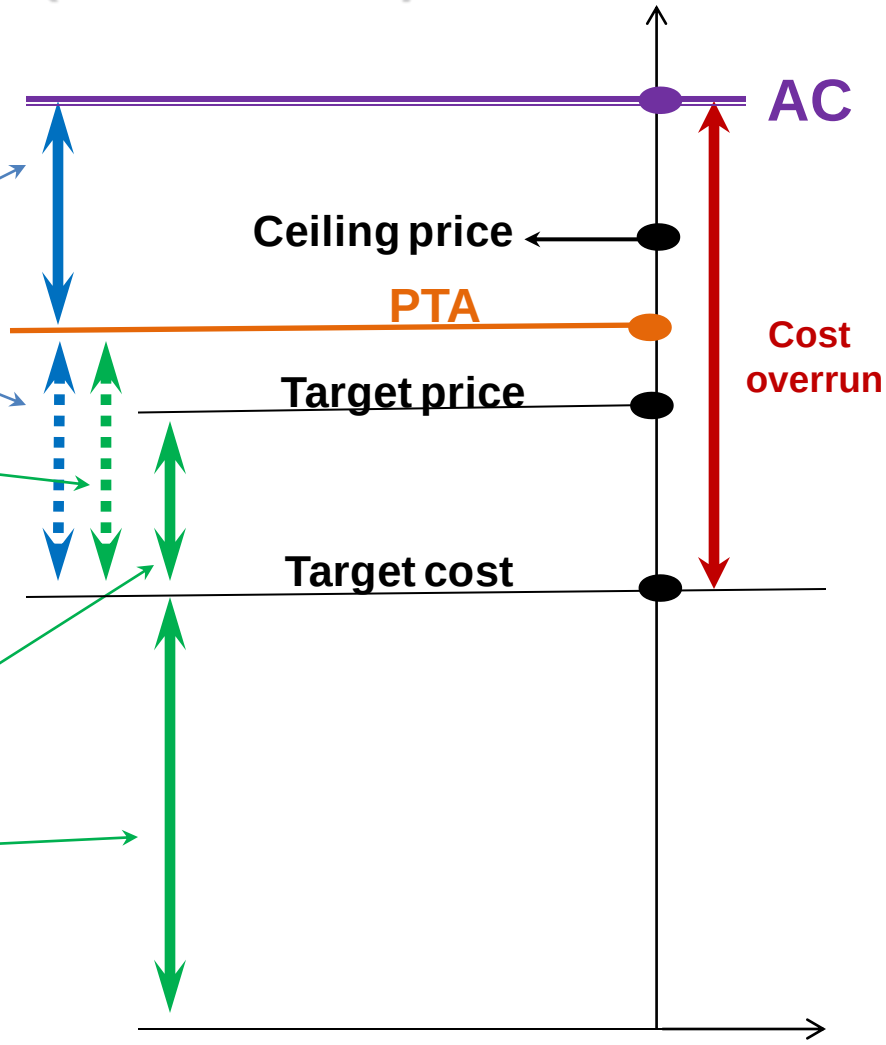


Fixed Price Incentive (FPI) Contracts - The case of cost overrun (AC > PTA)

Responsibility for the costs incurred:

- ***Seller (contractor, supplier) pays:***
  - All cost overruns above PTA
  - Seller's share of (PTA - target cost)
- ***Buyer (government) pays:***
  - Buyer's share of (PTA - target cost)

- ***Moreover, buyer also pays:***
  - Seller's profit (contractor's fee)
  - Target cost



Fixed Price Incentive (FPI) Contracts *Example 1*

- Assume that target cost is $2,000,000, target price is $2,200,000, ceiling price is $2,450,000 and the ratio is 80% buyer–20% seller for cost overruns. Beyond which cost level will the contractor start to assume total responsibility of contract costs?

- ANSWER:

$$PTA = \frac{ceiling\ price - target\ price}{buyer's\ Share\ Ratio} + target\ cost$$

$$PTA = \frac{2{,}450{,}000 - 2{,}200{,}000}{0.80} + 2{,}000{,}000 = 2{,}312{,}500$$

PTA = 2,312,500

The contractor will assume total responsibility for cost overruns when the cost reaches $2,312,300.

Fixed Price Incentive (FPI) Contracts *Example 2*

- A fixed-price-plus-incentive-fee (FPI) contract has a target cost of $150,000, a fixed fee of $20,000, a ceiling price of $200,000, and a share ratio of 80/20. The actual cost of the project was $195,000. How much will the contractor be reimbursed?

- ANSWER: AC > target cost ➔ *cost overrun*
- PTA = ((Ceiling Price – Target Price)/buyer's Share Ratio) + Target Cost = (200000 – (150000 + 20000)) / 80% + 150000 = **$187,500** ➔ ***AC > PTA***
- The contractor will be reimbursed (=the buyer will pay):
  - 100% of the original target cost: $150,000
  - the contractor's fee (or profit): $20,000
  - 80% (the buyer's share) of the cost overruns up to PTA:
    (PTA-target cost)*80% = (187,500 - 150,000) * 80% = $30,000
  - 0% for the cost overrun above PTA: $0 (Once the costs exceed the PTA of $187,500 the contractor (seller) pays 100%)
- In total the contractor will be reimbursed 150,000+20,000+30,000=**$200,000**

This corresponds to the ceiling price!

(in case AC>PTA, the buyer will pay only ceiling price)

Fixed Price Incentive (FPI) Contracts *Example 3*

- Same as Example 2, except that the actual cost of the project was $160,000. How much will the contractor be reimbursed?

- ANSWER: AC > target cost ➔ *cost overrun*
- PTA = **$187,500** ➔ ***AC < PTA***
- The contractor will be reimbursed (=the buyer will pay):
  - 100% of the original target cost: $150,000
  - the contractor's fee (or profit): $20,000
  - 80% (the buyer's share) of the cost overruns up to AC:
    (AC-target cost)*80% = (160,000 - 150,000) * 80% = $8,000
- In total the contractor will be reimbursed 150,000+20,000+8,000= **$178,000**

Fixed Price Incentive (FPI) Contracts *Example 4*

- A fixed-price-plus-incentive-fee (FPI) contract has a target cost of $130,000, a target profit of $15,000, a ceiling price of $160,000, and a share ratio of 80/20. The actual cost of the project was $150,000. How much profit does the seller make? How much will the contractor be reimbursed?

- ANSWER: AC > target cost ➔ *cost overrun*
- PTA = ((Ceiling Price – Target Price)/buyer's Share Ratio) + Target Cost = (160,000 – 145,000)/0.8 + 130,000 = **148,750** ➔ ***AC > PTA***
- The seller will pay for the overrun:
  - 0% of the original target cost: $0 (up to the target costs the buyer pays 100% of the costs)
  - 20% (the seller's share) of the cost overruns up to PTA:
    (PTA-target cost)*20% = 0.2*(148,750-130,000) = 3,750
  - 100% of the cost overrun above PTA: (AC-PTA)=150,000-148,750=1,250
- The seller profit was supposed to be (target profit) 15,000
  - In total the seller makes 15,000-3,750-1,250= $**10,000**
    - The actual cost of the project is higher than PTA (150,000>148,750) ➔ The buyer will pay only ceiling price, *i.e.* **$160,000.**

Fixed Price Incentive (FPI) Contracts - The case of cost underrun

- In case of cost underrun the seller is reimbursed by the buyer for the expected cost of the project and the contractor's fee. However, the seller shares a part of the savings (underrun) with the buyer, so the buyer can deduct his share of savings from the target cost.

- ***The contractor is reimbursed (buyer pays):***

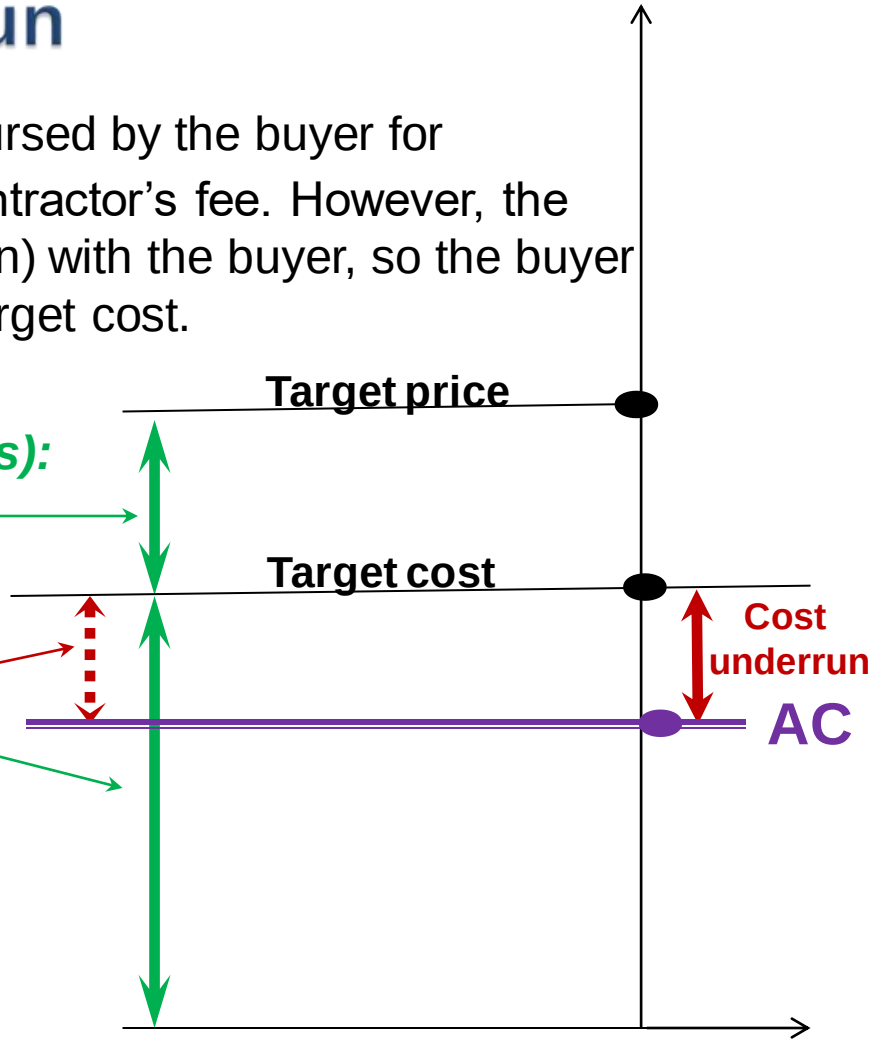
  Seller's profit (contractor's fee)

  Target cost

  MINUS

  Buyer's share of (target cost – actual cost)

  (the buyer gets back his share of savings)



Fixed Price Incentive (FPI) Contracts *Example 5*

- An FPI contract has the following characteristics:
  - Sharing ratio: 70/30
  - Target cost: $100,000
  - Target fee: $8,000
  - Price ceiling: $110,000
- How much will the contractor be reimbursed if the cost of performing the work is $90,000?
- What is the contractor's total profit?

- ANSWER: AC < target cost ➔ *cost underrun*
- The contractor will be reimbursed:
  - Target cost: 100,000
  - Contractor's fee (target fee): 8,000
  - ***MINUS*** Buyer's share of the savings (underrun): 70% of (100,000-90,000) = 7,000
- In total, the contractor will be reimbursed: 100,000 + 8,000 - 7,000 = **$101,000**

- The contractor's profit is: seller's fee + seller's share in the savings =
  = 8,000 + 30% of (100,000-90,000) = **$11,000**

Cost Reimbursable Contracts

- A **cost reimbursable contract (or cost-plus contract)**, is a contract where a contractor is paid for all of the allowed expenses to a set limit *plus* additional payment to allow for a profit.
- Used when there is **limited certainty** as to what the final cost will be and/or when **long-term quality is a much higher concern** than cost (space programs)
- Requires **additional oversight and administration** to ensure that only permissible costs are paid
  - ***Direct cost*** **-** directly related to producing products and services for the project can be traced back efficiently (salaries)
  - ***Indirect cost*** **-** not directly related to producing products and services for the project cannot be traced back efficiently (electricity)
- There is **less incentive to be efficient** compared to fixed cost contracts.
  - But target cost may be less than a fixed price contract because contractors do not have to inflate the price to cover their risk.
    - The buyer absorbs more risks than with fixed-price contracts

Cost Reimbursable Contracts

- **Cost plus fixed fee (CPFF):** the buyer pays the supplier for allowable performance costs plus a fixed fee payment (usually based on a percentage of estimated costs) agreed upon at the time of contract formation
  - **The buyer pays: actual cost + fixed fee**

- **Cost plus incentive fee (CPIF):** the buyer pays the supplier for allowable performance costs plus an incentive fee which consists of a predetermined fixed fee and an incentive bonus
  - The **incentive bonus** is based on the difference between allowable actual cost and target cost, on the share ratio (*i.e.* % of seller's share in the cost difference), and sometimes also on the predetermined min and max fees
    - Incentive bonus can be either negative or positive in the end
    - **Maximum and minimum fees** indicate the range within which the incentive fee the supplier can expect to get has to fall, based on the cost performance and the sharing ratio. The calculated final incentive fee is adjusted in the end.
- **The buyer pays: actual cost + fixed fee + seller's share ratio * (target cost - actual cost)**

incentive fee

Cost Reimbursable Contracts

- **Cost plus award fee (CPAF):** the buyer pays the supplier for allowable performance costs plus an award fee based on the satisfaction of subjective performance criteria.
  - For example, an aircraft development contract may pay award fees if the contractor achieves certain speed, range, or payload capacity goals.
  - **The buyer pays: actual cost + award fee**
- **Cost plus percentage of costs (CPPC):** the buyer pays the supplier for allowable performance costs plus a predetermined percentage based on total costs
  - The (percentage-based) fee rises as the contractor's cost rises.
  - Since it provides **no incentive for the contractor to control costs**, this type is rarely utilized. It is prohibited for US federal government use.
  - **The buyer pays: actual cost + % profit of actual cost**

Cost Reimbursable Contracts: *Example 1*

- In a CPIF contract, the expected cost of a project is $200,000, the fee to the supplier is $30,000, and the buyer absorbs 80% of the uncertainty.

(1) If the final cost of the project is $150,000, what is the total payment for the supplier? What is the supplier's profit?

(2) If the final cost of the project is $250,000, what is the total payment for the supplier? What is the supplier's profit?

- ANSWER:
  - (1) The buyer pays: actual cost + fixed fee + seller's share ratio * (target cost - actual cost) = 150,000 + 30,000 + 20%*(200,000-150,000) = 150,000 + 30,000 + 10,000 = **$190,000**
    - Supplier's profit (incentive fee)= fixed fee + incentive bonus = 30,000 + 10,000 = **$40,000**
  - (2) The buyer pays: actual cost + fixed fee + seller's share ratio * (target cost - actual cost) = 250,000 + 30,000 + 20%*(200,000-250,000) = 250,000 + 30,000 - 10,000 = **$270,000**
    - Supplier's profit (incentive fee)= fixed fee + incentive bonus = 30,000 - 10,000 = **$20,000**

Cost Reimbursable Contracts: *Example 2*

- A cost-plus-incentive-fee (CPIF) contract has the following characteristics:
  - Sharing ratio: 80/20
  - Target cost: $100,000
  - Target fee: $12,000
  - Maximum fee: $14,000
  - Minimum fee: $9,000
- How much will the seller be reimbursed if the cost of performing the work is $120,000?

- ANSWER:
  - Incentive fee: fixed fee + (target cost – actual cost) * seller's sharing ratio= = 12,000 + ($100,000 – $120,000) * 20% = 8,000
  - This incentive fee is lower than the minimum fee. Thus, the $8,000 will be adjusted upwards to $9,000 (the minimum amount).
  - In total, the seller will be reimbursed (the buyer will pay): actual cost + final adjusted incentive fee = 120,000 + 9,000 = **$129,000**

Cost Reimbursable Contracts: *Example 3*

- In a procurement contract, the buyer pays the supplier for allowable performance costs plus a predetermined fixed fee, but there is no incentive bonus.

(1) Which type of contract is this?

(2) Suppose the expected cost of a project is $200,000 and the fee to the supplier is $30,000. If the final cost of the project is $150,000, what is the total payment for the supplier? What is the supplier's profit?

(3) If the final cost of the project is $250,000, what is the total payment for the supplier? What is the supplier's profit?

- ANSWER:
  - (1) **Cost plus fixed fee (CPFF).**
  - (2) The payment for the supplier: actual cost + fixed fee =150,000 + 30,000 = **$180,000**
    - Profit (= the fixed fee): **$30,000**
  - (3) The payment for the supplier: actual cost + fixed fee = 250,000 + 30,000 = **$280,000**
    - Profit (= the fixed fee): **$30,000**

    - The contractor will receive the full cost reimbursement and the same fixed fee whether there is cost overrun or underrun. The **final profit will be $30,000** in both cases.

Cost Reimbursable Contracts: *Example 4*

- A cost-plus-percentage-cost (CPPC) contract has an estimated cost of $120,000 with an agreed profit of 10% of the costs. The actual cost of the project is $130,000. What is the total reimbursement to the seller?

- ANSWER:
  - Estimated Cost= $120,000
  - Actual Cost= $130,000
  - Agreed Profit=10%
- Reimbursement amount= Actual cost+% profit of actual cost=

=$130,000+(10% of $130,000)=**$143,000**

- The total reimbursement to the seller is **$143,000.**

Contract Types versus Risk

Project Procurement Management Summary

- Project procurement management involves acquiring goods and services for a project from outside the performing organization
- Processes include:
  - Plan procurements
  - Conduct procurements
  - Administer procurements
  - Close procurements