GEEM 445

Engineering Ethics and Professional Practices

Project Characteristics and Estimates

What we are going to learn today?

- What is a project?
- Characteristics of Project.
- Fundamental criteria of project.
- Types of project based on different characteristics.
- Project Life Cycle.
- Methods of cost estimation of project.
- Project time estimation

What is a Project?

According to Project Management Institute (PMI), USA:

“ A project is a **one-shot**, **time-limited**, **goal-directed**, **major undertaking**, **requiring the commitment** of varied skills and resources”

“A **combination** of **human and non-human resources** **pooled** together in a **temporary organization** to **achieve** a **specific purpose**”

Characteristic Features of a Project (OL-ST LUC-MUR)

- **Objectives**

A project has a **fixed set of objectives**. Once the objectives have been achieved, the project ceases to exist.

- **Life span**

A project cannot continue endlessly. It has to come to an end.

- **Single entity**

A project is one entity and is normally entrusted to **one responsibility center** while the participants in the project are many.

- **Team work**

A project **calls for team work** and the team again is constituted of members belonging to different disciplines, organizations and even countries.

- **Life cycle**

A project has a life cycle reflected by growth, maturity and decay.

- **Uniqueness**

No two projects are exactly similar even if the plants are exactly identical or are merely duplicated.

- **Change**

A project sees many changes throughout its life.

- **Made to order**

A project is always made to the order of its customer.

- **Unity in diversity**

A project is a complex set of thousands of varieties, but they remain inter-related.

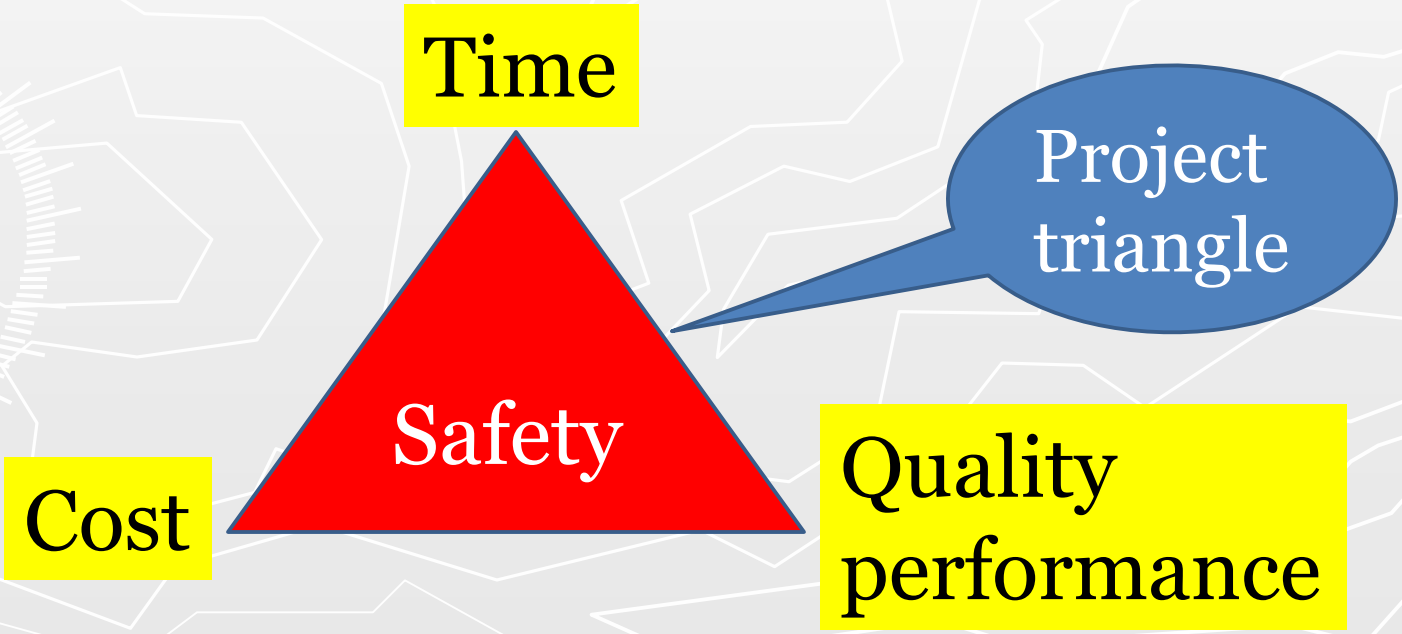
- **Risk and uncertainty**

Every project has risk and uncertainty associated with it

Fundamental criteria a Project must meet:

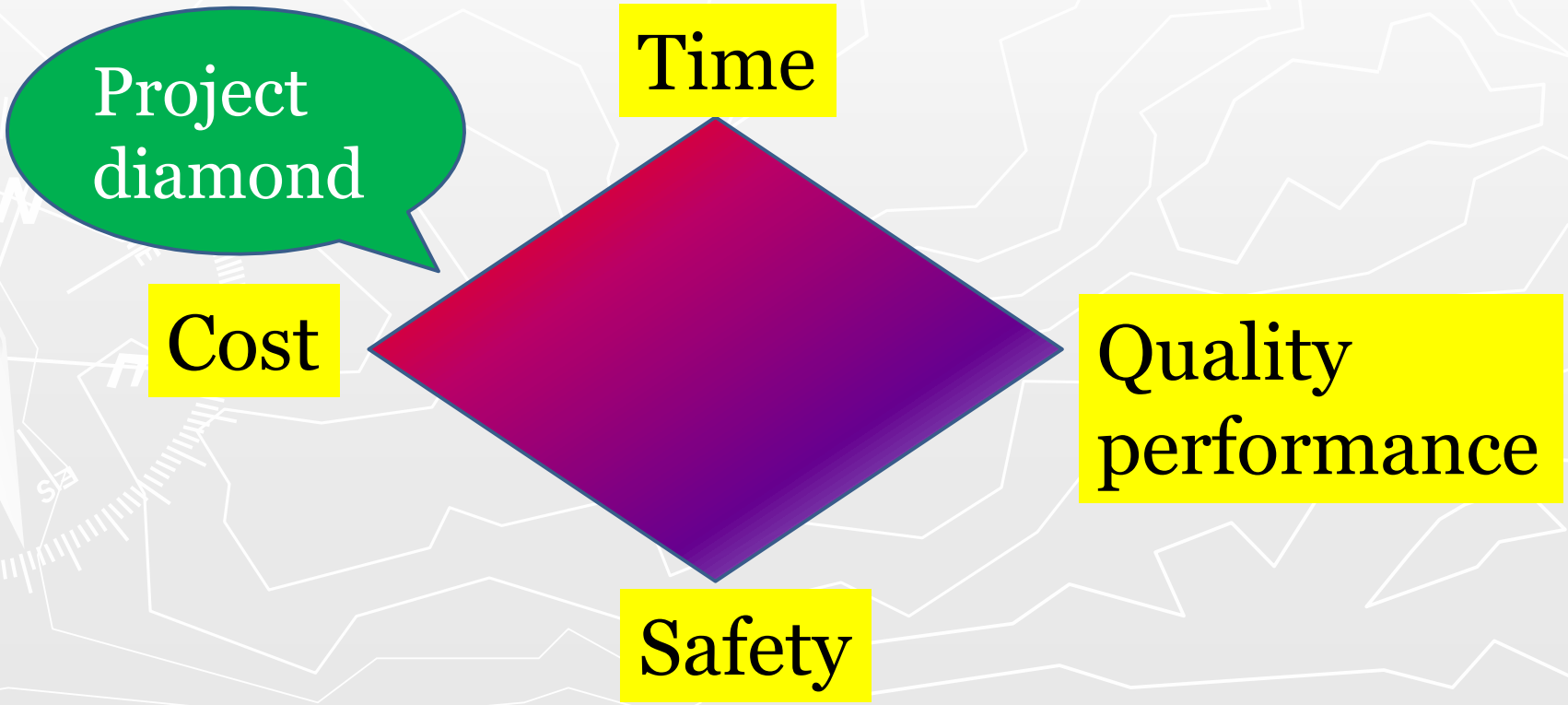
Project Triangle: A project must meet three fundamental criteria :

- To be completed on **time.**
- To be accomplished within **budgeted cost**.
- Must meet prescribed **quality requirements**.



Project Diamond- Fundamentals

When we add safety as a major part (as required in an aircraft or motorcar project etc.) of project, triangle can be presented by a diamond shape :



Types of Project: Based on Fundamental Criteria

- **Time-Bound Project** : A project where **time gets priority over cost** and **performance** etc.

Example : **Opening of a bridge** project in time while many minor works (lighting, painting & marking works etc.) are still on progress.

T-20 World Cup In BD

- **Cost-Bound Project** : A project where **cost can not be exceeded** in any circumstances. If required **project specification** and **performance** can be negotiated but **not the cost**.

Example : **Completing a building project** by reducing the specification of the internal fittings and fixtures to meet the allotted budget.

- **Performance (quality) -Bound Project**: A project where **specification must be met** regardless **of cost and time.**

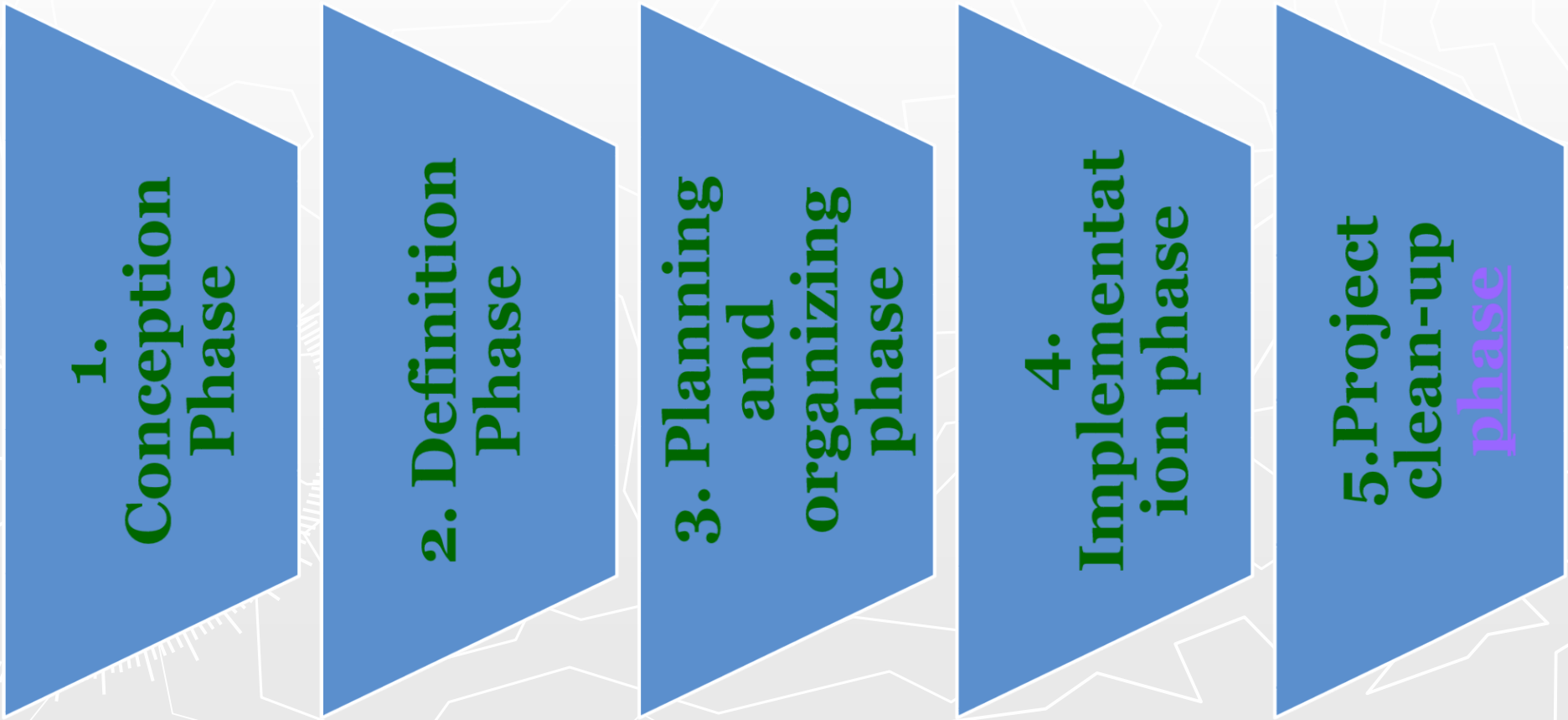
Example : A power plant project designed to produce specific output or a new weapon project that must meet client's performance specification.

- **Safety -Bound Project** : **All projects that are to be safety bounded**. Some **project may terminate even for a minor safety failure.**

Example : **A nuclear power plant project** may be abandoned if minor safety breach endangers surrounding environment.

Project Common Life Cycle Phases

ALL PROJECTS HAVE TO GO THROUGH FIVE COMMON PHASES



Project Life Cycle Phases

- **Conception Phase**: During which the **project idea germinates.**

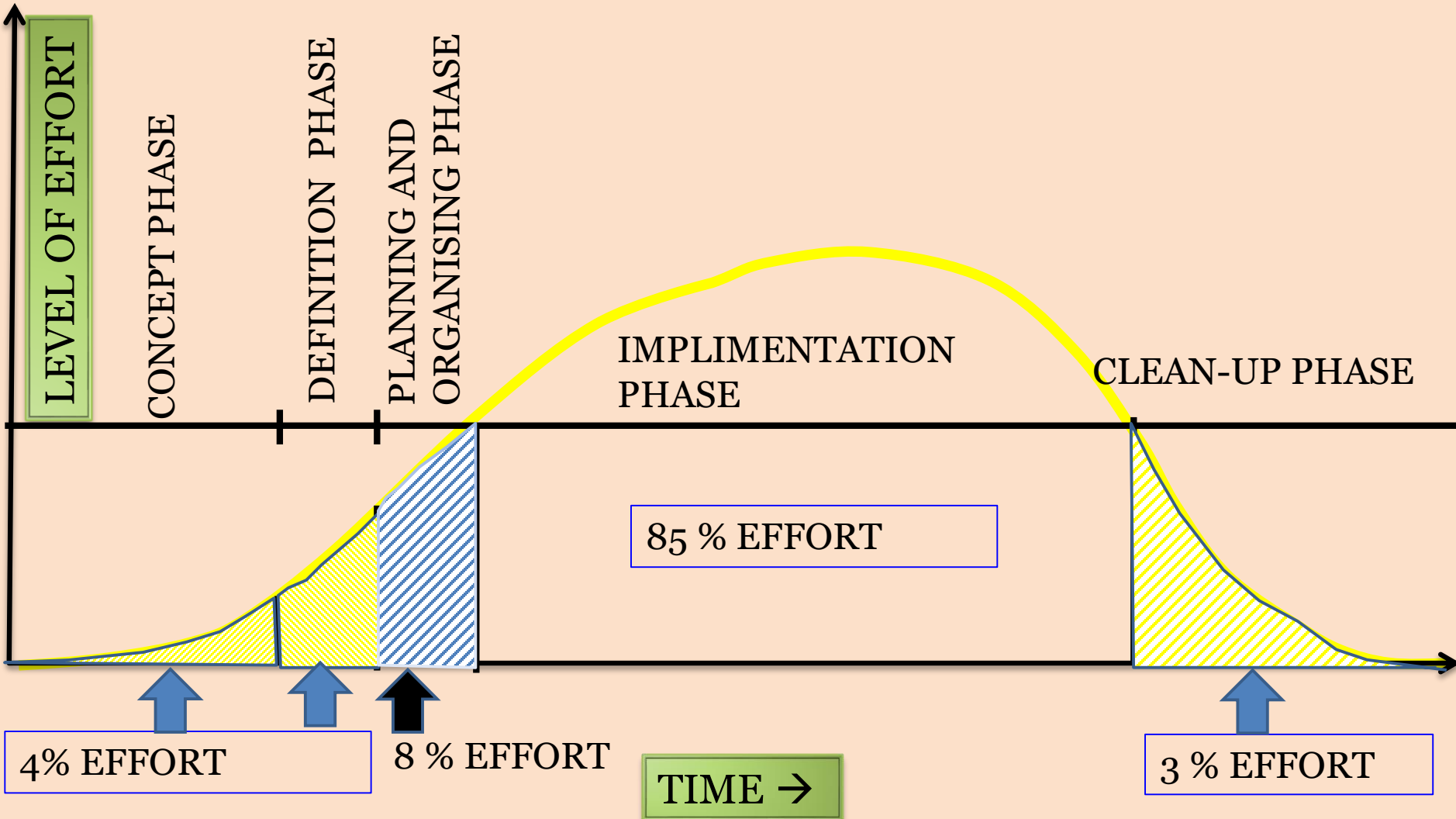
- **Definition Phase:**
  - **Develop the idea** generated during conception phase and
  - **Prepare a document** describing the project in details for the Development partners/Clients to make up their minds on project ideas.
  - **Areas of examination**: raw materials survey, location and site, technology selection, project layout, civil engineering works, manpower pattern, financial analysis, implementation schedule

- **Planning and Organizing Phase**: This phase **overlaps** with definition and implementation phase.

- **Implementation Phase:**
  - Something **starts growing in the field** and people can feel.
  - **Preparation of specifications** for works/equipment, construction **drawing**, lining up **contractors**, **trial run** and **commissioning**.

- **Project Clean-up Phase**: Project **hand over to client**, including drawing, documents, operation and maintenance manual.

Project Common Life Cycle Curve with % of Efforts



Preparation of Cost Estimate

What do you mean by the cost estimate of a project?

- A project cost estimate is required not only for **assessing fund requirement** but also for **ascertaining the economic viability** of the project.

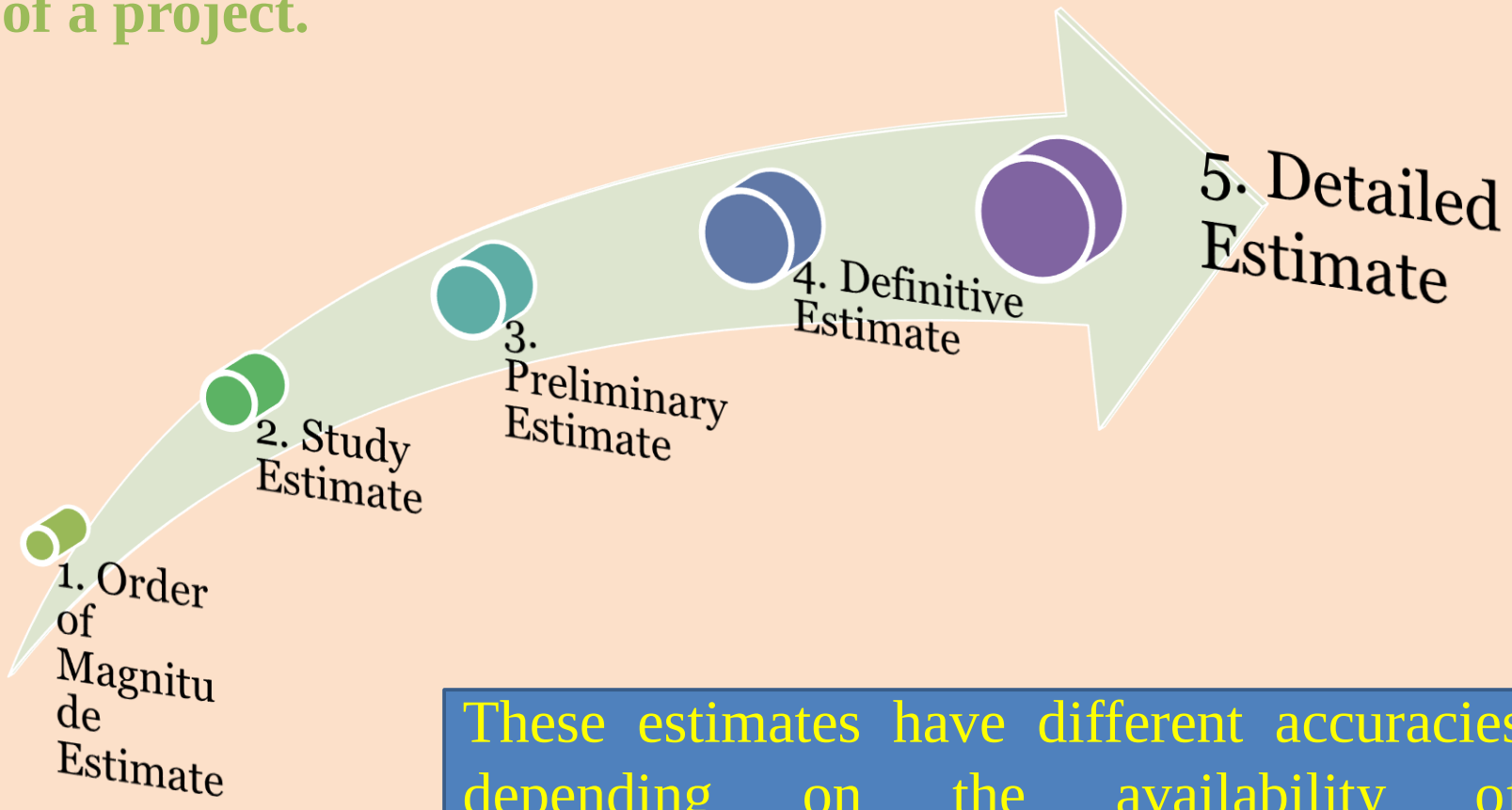
- If the cost of the project is **not estimated accurately** the **fund plan will consequently be inaccurate**.

- But the **accuracy is not so easy to ensure** as there exist always **lack of complete information** at different stages of a project.

- So **repeated estimate** **at different stages of the project cycle is required.**

Types of Project Estimates (repeated) during life cycle

Roughly five types of estimates (Repeated) that are made during the life cycle of a project.



These estimates have different accuracies depending on the availability of information

Order of Magnitude Estimate

- **Estimate is made when a project has been identified** and the entrepreneur wants to get **rough idea of the investment** so as to decide whether **to pursue the project or not .**
- **It is simply a guess estimate.**

Can have an accuracy of **± 60%**

Example: Construction of 60 km Highway Project Tk. 140 Crore

Study Estimate

- Estimate is for of the project, **studying the economic viability**
- **Project is approved** with this estimate.

Accuracy of estimate at this stage is about **± 30%.**

In **public sector**, **project is revised if** actual cost over-run this estimate by 20%.

Preliminary Estimate

- Estimate is based on **final technology package** and a **firm implementation schedule is available** at this stage.
- A **significant development** in the life cycle of a project.

- Accuracy of cost estimate is about **± 20%**
- At this stage **budget allocation is frozen** and a **basis of control is established.**

Definitive Estimate

- Estimate is **prepared after the zero date** (date of project commencement).
- Accuracy of cost estimate is about **± 10%**

- At this stage **definite information** like, equipment purchase specification, job awarded cost, schedule of items for works and goods, general drawings etc. are available.
- **Contributes an added accuracy** to estimate.

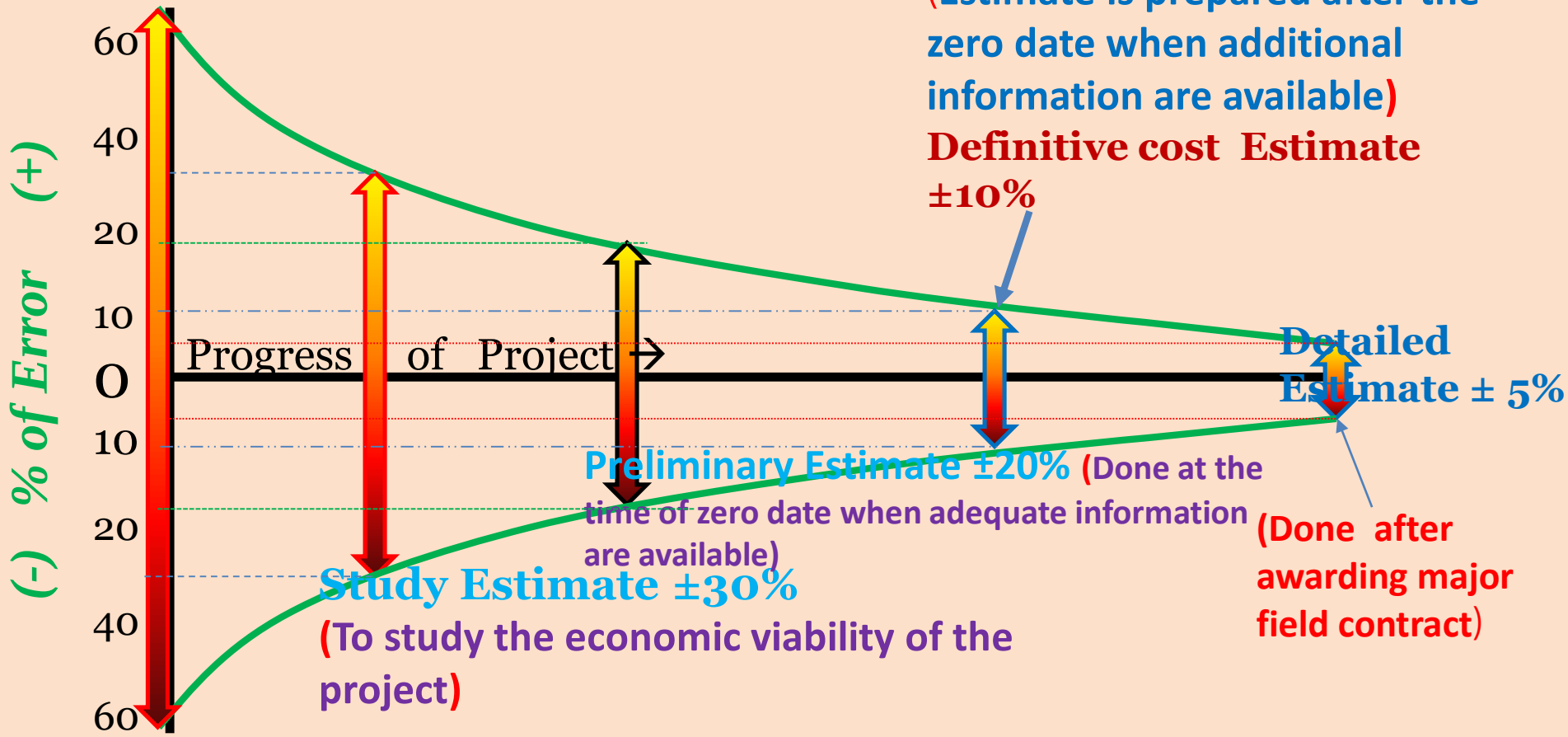
Detailed Estimate

- Estimate is made **much beyond zero date** on **completion of contract**, **ordering machinery and equipment** and when **90% construction drawings** are available.
- Accuracy of cost estimate at this stage is about **± 5%**

- Estimate is **unable to achieve 100% accuracy** since it can not cover construction phase.

- 100% accuracy can be obtained only when construction phase is over and the project moves in to full scale operation.

Various Types of Estimate – At a glance



Importance of project time estimates

- Implementation schedule is **based on setting a time target** for project implementation/completion.
- **Time is not much dependent on quantum of** work as that of cost. Moreover, **time is a commodity that can be bought** with increased cost.
- **Duration of a project can be compressed** by putting additional resources on the job.
- Hence, **time estimate has not received as much attention as cost estimate. Yet it draws significant attention in many project**.

Basis of Time Estimate

- Time estimate is made by making a **work breakdown** in the project, estimating the time schedule for each work, putting them in proper sequence (i.e. in series or parallel, or as per technical)
- Finally **matching their build up on a time scale** with available resources.
- Time is **not merely what it takes to do**, but also how much time we want the work to take

Basis of Time Estimate

Time Study Approach.

Example:

Let's say a task takes an average of 2 minutes per cycle (Average Time). If the worker is rated at 110% (meaning they are 10% faster than average), and there's a 15% allowance for breaks, the calculations would be:

Normal Time: 2 minutes * (110/100) = 2.2 minutes
Standard Time: 2.2 minutes * (1 + 0.15) = 2.53 minutes

Therefore, the standard time for the task would be 2.53 minutes.

Previous project data:

- Data from **recently completed** projects are used
- Often these data are used for estimating **broad work package duration**
- Data from **foreign projects** are also used if same are not locally available

- **Guesstimating Approach**: $t_e = (t_o + 4t_m + t_p)/6$

  t_o = Optimistic time (all goes smoothly)

  t_p= Pessimistic time (includes all possible adverse situation)

  t_m = Most likely time, t_e= Expected time

- **Range estimates**:

Expressed in range from past data or guestimate

- **Time taken vs. time required:**

Actual activity time always expands to consume the time allowed (Parkinson's law: **Parkinson's Law** states that work expands to fill the **time** allotted for its completion. ... We naturally pace ourselves to finish a **project** in the nick of **time**. The same task can take one **hour** or one week depending on **how much time** we give ourselves to complete it.)

- **Estimates from vendors:**

May not be so accurate but in competitive situation may provide realistic estimate

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Thanks