ESE 2024

UPSC ENGINEERING SERVICES EXAMINATION

Preliminary Examination

General Studies and Engineering Aptitude

Basics of Project Management

Comprehensive Theory *with* Practice Questions
and ESE Solved Questions

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ESE 2024 Preliminary Examination: Basics of Project Management

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2nd Edition : 2017
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Preface

B. Singh (Ex. IES)

The compilation of this book **Basics of Project Management** was motivated by the desire to provide a concise book which can benefit students to understand the concepts of this specific topic of General Studies and Engineering Aptitude section.

This textbook provides all the requirements of the students, i.e. comprehensive coverage of theory, fundamental concepts and objective type questions articulated in a lucid language. The concise presentation will help the readers grasp the theory of this subject with clarity and apply them with ease to solve objective questions quickly. This book not only covers the syllabus of ESE in a holistic manner but is also useful for many other competitive examinations. All the topics are given the emphasis they deserve so that mere reading of the book clarifies all the concepts.

We have put in our sincere efforts to present detailed theory and MCQs without compromising the accuracy of answers. For the interest of the readers, some notes, do you know and interesting facts are given in the comprehensive manner. At the end of each chapter, sets of practice question are given with their keys and detailed explanations, that will allow the readers to evaluate their understanding of the topics and sharpen their question solving skills.

Our team has made their best efforts to remove all possible errors of any kind. Nonetheless, we would highly appreciate and acknowledge if you find and share with us any printing and conceptual errors.

It is impossible to thank all the individuals who helped us, but we would like to sincerely thank all the authors, editors and reviewers for putting in their efforts to publish this book.

With Best Wishes

B. Singh

CMD, MADE EASY Group

Basics of Project Management

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1 Basic Concepts and Project Life Cycle

1.1 WHAT IS PROJECT?

A project is accomplished by performing a set of interrelated activities over a fixed period within certain cost and specifications. Projects are temporary and unique.

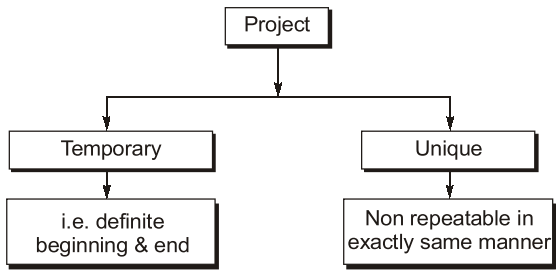


Fig. *Feature of a project*

- Temporariness of projects indicates that they are time bound and have a definite beginning and definite end. It has fixed time span.
- Uniqueness of projects means that they have be created for the first time and are not repeatative or routine.

Project has been defined in various ways. Some of popular definitions are:

- *According to* ***Little and Mirrlees,*** *"A project is any scheme or a part of scheme for investing resources which can be reasonably analysed and evaluated as an independent unit."*
- *According to* ***Harison,*** *"A project can be defined as a non-routine, non-repetitive, one-off undertaking, normally with discrete time, financial and technical performance goal.*

According to Project Management Institutes PMBOK guide.

"A project is a temporary endeavours undertaken to create a unique product, service or result".

Example of projects:

- Development of a software for a business.
- Construction of a building.
- Setting up a power plant.
- Expansion of sales in a new geographic market, etc.

1.2 CLASSIFICATION OF PROJECTS (TAXONOMY OF PROJECTS)

Projects can be classified under different heads as follows:

1. Classification based on type of work
   (a) Industrial projects
   (b) Non-industrial projects
      - Infrastructure projects
      - Irrigation projects
      - Building projects
      - Educational projects

- Health care projects
- Advertising and marketing projects
- IT and computer projects
- military and aerospace projects
- Event management projects
- Bank projects

2. Classification on the basis of Project Completion Time
   (a) Long duration projects (Completion time more than 5 years)
   (b) Medium duration projects (3 to 5 years)
   (c) Short duration projects (1 to 3 years)
   (d) Special short duration (Less than 1 year)

3. Classification on the basis of project value
   (a) Mega value projects (> Rs. 1000 crores)
   (b) Large value projects (Rs. 100 crores to 1000 crores)
   (c) Medium value projects (Rs. 1 crores to 100 crores)
   (d) Small value projects (Cost less than 1 crore)

4. Classification on the basis of ownership
   (a) Private sector projects (b) Public sector projects
   (c) Joint sector project (PPP) (d) Government sector projects

5. Based on the basis of pace of work
   (a) Normal track projects (b) Fast track projects

Which of the following are project?

1.	Reading a New Book	Yes
2.	Maintaining of New constructed Road	No
3.	Mass Production in a Car Plant	No
4.	Designing a New Product	Yes

1.2.1 Project Vs Operations

Operations is an ongoing work effort following repetitive process & producing same output or service.

Similarities of Project and operation are:

1. Both consume time and resources
2. Both are executed by individuals
3. Both has some similar phases i.e. planning execution & control
4. Both are executed to meet strategic & organisational objective

Differences of project and operation are:

Project	Operations
Temporary, Unique	Ongoing, repetitive
In Project more skills, are required	It requires limited skills as the process is repetitive
Risk are high at start as no. of unknown and unpredictable elements are present	Risk are not high as it is repetition of activities
A project has definite start and end.	Operations don't have a definite end
Risk are evaluated continually	Here processes are designed to minimise risk.

NOTE : Point of view also plays important role to distinguish project and operation. For customer work effort is project whereas for organisation it is operation as they do it all time.

1.3 WHAT IS MANAGEMENT?

Management is an act of getting people together to accomplish a work or goal using available resources efficiently and effectively.

Management process involves: In the project management context, a project management process consists of a linear sequence of processes:

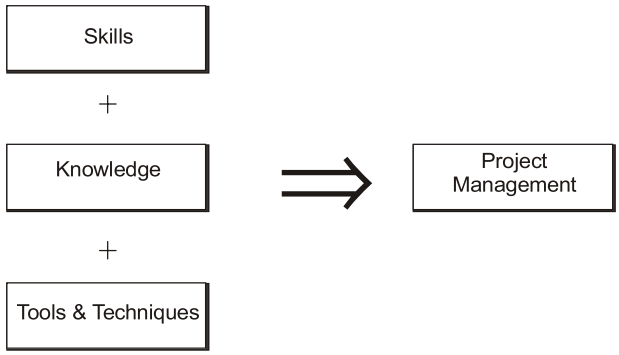
- Initiation process
- Execution process
- Closing process
- Planning process
- Monitoring and control process

There are various type of resources within management:

(a) Human resources
(b) Financial resources
(c) Time resources
(d) Technological resources
(e) Mechanical resources
(f) Natural resources

1.4 WHAT IS PROJECT MANAGEMENT?

Project management is an application of knowledge, skills, tools and techniques to meet the project requirements. The objective is to use the optimum resources to accomplish a goal in minimum time.



The 7-S of Project Management

The 7-S framework provides a comprehensive set of issues that need to be considered. It also allows classification of tasks within the remit of the project manager, which reduces the complexity of the role. In addition, classifying issues in this manner ensures that the project manager will know where to look to find sources of help if novel situation arises. Knowing that interpersonal problem in a team are aggravated by the style /culture that a project manager promotes provides a means for finding solutions to the problem

Strategy: The high-level requirements of the projects and the means to achieve them

Structure: The organizational arrangement that will be used to carry out the project

Systems: The methods for work to be designed monitored and controlled

Staff: The selection, recruitment, management and leadership of those working on the projects

Style / culture: The underlying way of working and inter-relating within the work team or organization

Stakeholders: Individuals and groups who have an interest in the project process or outcome

1.5 CHARACTERISTICS OF PROJECT MANAGEMENT

1. **Project Charter:** The project charter is one of the special project management documents that translates the project sponsor's business case into project objectives.
2. **Tools and Techniques:** The management of projects uses a number of special tools and techniques, combined with subject related knowledge and skills that have been developed over the years to manage different aspects of the project and facilitate the processing of large amounts of data. These include the CPM analysis, the Gantt chart, the resource histogram, the earned value graph and tables, activity crashing and matrix organization structures.
3. **Project Plan:** The project plan is a special project management document integrating the knowledge areas with individual plans to form one combined baseline plan.
4. **Project Management Processes:** The project management process is a special management technique for managing a linear sequence of steps or interrelated actions performed to achieve a specified set of projects, results or services. The project management process is subdivided into the following sub processes (initiation, planning, execution and closing).
5. **Project Organization Structure:** The project organization structure is a special management technique that enables the project manager to form temporary organization structures and project teams that can be designed to suit the needs of the project and the project participants. The enables the project leader to build and motivate the team and coordinate their work.
6. **Project Methodology:** The project lifecycle format is a special management technique subdividing the project into a number of identifiable phases that each produce a distinct deliverable. This sequence of phases forms the backbone of the project methodology, interlinking all the topics within a phase and between phases.

Do you know?: A product life cycle has five stages among which project management is done in development stage

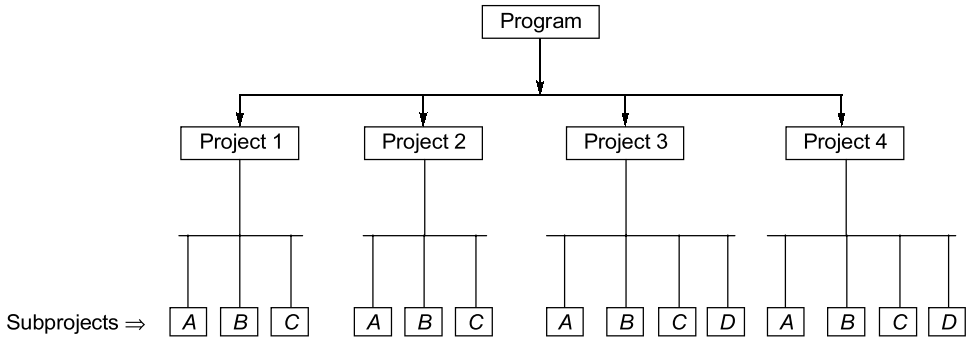
Note : 1. A portfolio can contain programs or projects specifically to meet strategic objectives.
2. Program → Group of related Projects.

1.6 DIFFERENT TYPES OF MANAGEMENT

1. **General Management:** The successful project manager must also be competent in a wide range of general management skills. These include:
   - Recruiting and team selection
   - Sales and marketing
   - Project economics
   - Legal contracts
   - Personnel and human resources
   - Accounts and salaries
   - Computer systems
2. **Production Management:** Although projects are deemed to be unique, in reality they usually consist of a number of similar and repetitive tasks that could be grouped and made using a production line approach.
3. **Process Management:** Process management is used by companies that manage a product that typically flows from one process to another.
4. **Programme Management:** A programme is a set of related projects and organizational changes put in place to achieve a strategic goal and to deliver the benefits that the organization expects.
5. **Portfolio Management:** Portfolio management could be used by a project office that is running a number of unrelated projects such as managing the repairs and maintenance of a large telecom type company, a power station or a water utility.

A portfolio is a set of projects and/or programmes that are not necessarily related but are brought together for the sake of control, co-ordination and optimization.

Portfolio management is mainly applied to groups of projects and programmes that might not be related in the business sense but draw on a common pool of scarce resources. The portfolio manager co-ordinates all the projects and possible programmes within an organization during the process of evaluation, selection, monitoring and controlling, reprioritization and closure.

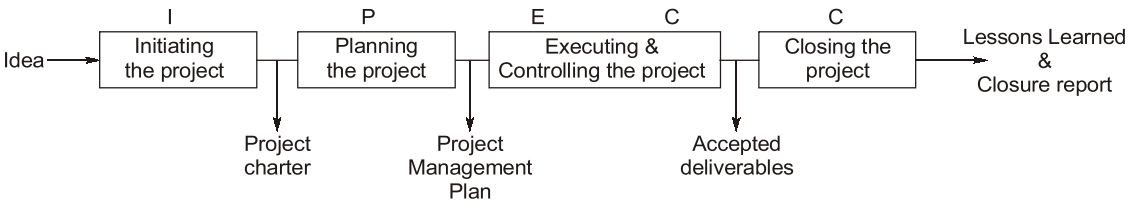


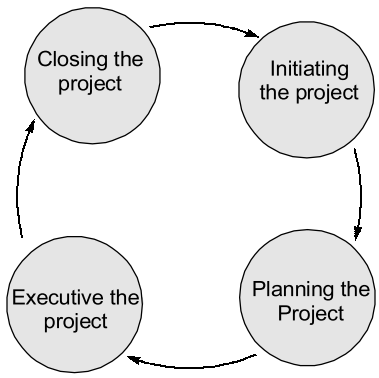
1.7 PROJECT LIFE CYCLE

- The project life cycle shows how a project can be subdivided into a number of phases presented sequentially along a project timeline.
- Every project has certain phases of development. A clear understanding of these phases allows managers and executives to control the project more efficiently.
- All the phases of a project from start to end are known as life cycle phases. The project life cycle i.e. number of phases may differ from project to project.

The main phases of life cycle are:

1.7.1 Project Life Cycle (4 Phases)



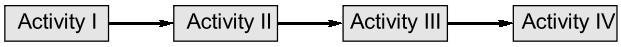


Project Life Cycle

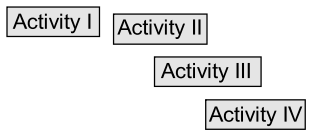
Monitoring and control processes is an integral part of all the process groups, and interact with each process in numerous ways:

Type of Relation between Activities of a Project:

1. **Sequential :** Finish to start Relationship i.e. one phase starts when the preceeding has finished.

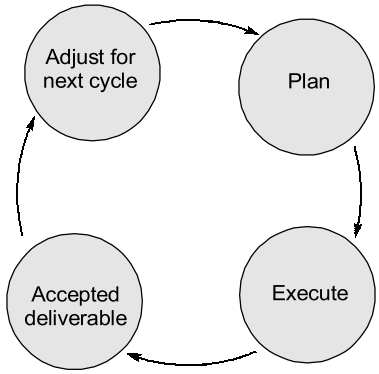


2. **Overlapping :** Here the subsequent phase can begin before the previous has finished.



It saves time and generally done for IT Projects.

3. **Interative :** This phase type is particularly useful with Projects in which there are uncertainities rapidly changing market conditions or complete unknowns.



Concurrent Engineering: Concurrent engineering, or simultaneous engineering or Integrated Product Development or Agile, is a work methodology where the various areas required to bring a product from conceptualization to sales is done in parallel as opposed to step-by-step. The result is decreased time in product/service realisation/completion leading to increased time to market resulting in more sales and early market capture. Said areas could include research and development, design, manufacturing, testing, etc. for the product or project.

Phase-1. Feasibility Stage or Conception Stage/ Initiation stage

- The feasibility phase assesses the business case to confirm it is feasible to manufacture and implement.
- If there are number of possible business case solutions the feasibility study will rank the business cases in order of how well they are addressing the client's requirements.
- This is the phase when a problem is identified and potential solutions are suggested i.e. ideas are conceived.
- After feasibility study once the objectives have been clearly defined then the appraisal of the solutions is conducted in terms of risk, financial commitment and benefits.
- In case project ideas are found feasible from all considerations it is then given *'go ahead'* signal.

Phase-I of the project can be summarized as under:

(a) Identification of the need
(b) Establishment of the primary feasibility of project idea

(c) Identification of alternatives
(d) Evaluation / appraisal of the alternatives
(e) Investment decision

Phase-2. Design Stage (Planning & Scheduling Stage)/Definition Phase

- The project definition phase uses the guidelines from the feasibility study to design the product, outline the build-method and develop detailed schedules and plans (baseline plan) for all the knowledge area topics required to make the project.
- Once the investment decision is taken, the design or the planning stage of project starts.
- In this phase original ideas are amplified to prepare ***'blue print'*** for next stage. It means technical parameters are frozen and basic designing is completed and specification for equipments are finalized, costs are estimated in details, a time schedule for the project is planned and steps are taken for raising funds and resources at the end of the design phase blue print is ready for execution. The output of design phase is called ***"Detailed Project Report (DPR)"***.
- Usually DPR is further examined by the concern organisation. From first phase to second phase of the project life cycle, ***the intensity of activities continuously increases.***

Phase-3. Execution or Production Phase

- The project execution phase uses the design and project plan from the definition phase, together with the execution strategy, to construct the project.
- In third phase project moves for execution or production where the emphasis is given to give physical shape to the ideas presented in DPR.
- In this phase procurement of resources (material/machinery) starts.
- **The intensity of activities further builds up and reaches to peak in 3rd phase, however when execution approaches to completion the intensity of activities start falling again.** This is most important phase. The demands on the project manager is at its peak in this phase.
- There is a great need of continuous monitoring and control to all activities in this phase.

Phase-4. Termination or Commissioning or Handover Phase

- The project commissioning and handover phase inspects and confirms the project has been made to the approved design and then hands over the project to the client for operation.
- It is the last phase of the project cycle. During this phase the constructed facilities are tested one by one and final teething problems are solved. If trial is successful then the commissioning is complete.
- After commissioning, the project is handed over. This stage might include training of operating personals. In this phase ***intensity of activities reduces*** to minimal at the end.

Life cycle graph between intensity of activities and time:

Phase-I → Feasibility/Appraisal/ Conception
Phase-II → Design/Planning and scheduling / Development/ Definition
Phase-III → Implementation / Execution/Production
Phase-IV → Commissioning/Termination/ Transfer

The important elements of a project life cycle are:

1. Operations /activities; which should be performed in sequence.
2. Resources: manpower, material, money machinery etc.
3. Constraints and external conditions.

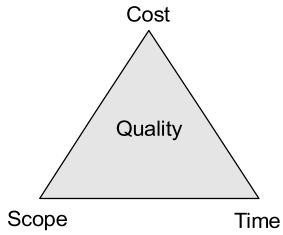
1.8 PROJECT CONSTRAINTS

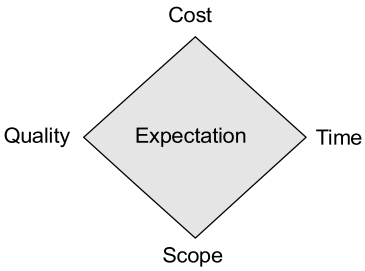
With any project, there are limitations and risks that need to be taken into account and addressed to ensure the project's ultimate success. The three primary constraints that project managers should be familiar with are time, scope and cost. These are frequently known as the triple constraints or the project management triangle.Each constraint is connected to the other two; so, for example, increasing the scope of the project will likely require more time and money, while speeding up the timeline for the project may cut costs, but also diminish the scope.

There are four main parameters of a project management

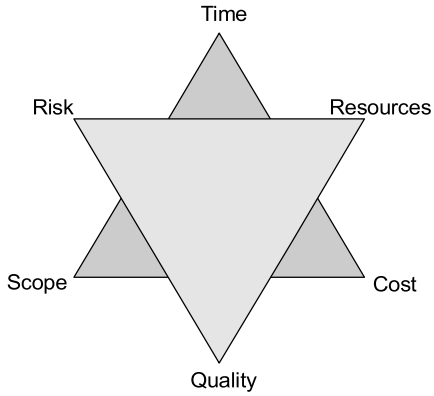
1. **Time :** Time is very crucial to any project. Alteration of Project completion time changes the cost.
2. **Scope :** Scope tells what needs to be achieved and the work that must be done to deliver a project.
3. **Cost :** Cost is the monetary value of a Project. Cost is directly dependent on time and scope and the quality to be produced.
4. **Quality :** This is the standard of something as measured against other things of a similar kind, the degree of excellence of something.

The Triple Constraint: Here any change in one Parameter will most likely affect others. All three constraints of scope, cost and time are interrelated and changing any one will result in changing the other two also. The resultant of the three is quality.





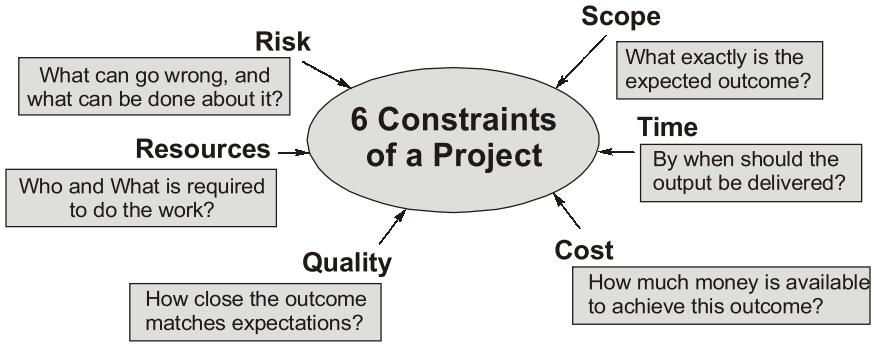
The Diamond Constraint: The Project management diamond constraint include cost, quality, time and scope.



The Sextuple Constraint: Now-a-days apart from time cost and scope risk quality and resources are also constant for better understanding.

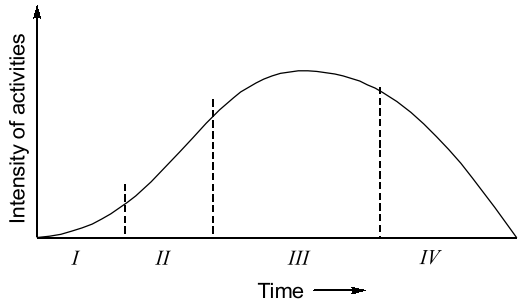
A risk is an event that may or may not happen. If it does happen, it will have unwanted consequences and will result in losses.

Here the change in any constraint will affect the other in order to maintain the expectation diamond. A constraint limits the execution of project or process.



1.9 LEVEL OF EFFORT (INTENSITY OF ACTIVITIES)

The project lifecycle is often presented with its associated level of effort. The level of effort could be any parameter that flows through the project that can be measured, but it is most commonly expressed as man-hours or expenses/costs. The level of effort is a useful indicator for the project manager to quantify the amount of work to be performed and the amount of work completed within each phase. These parameters can be presented as a line graph of '*rate of expenditure*' (or rate of effort) and/or a line graph of '*cumulative expenditure*'.



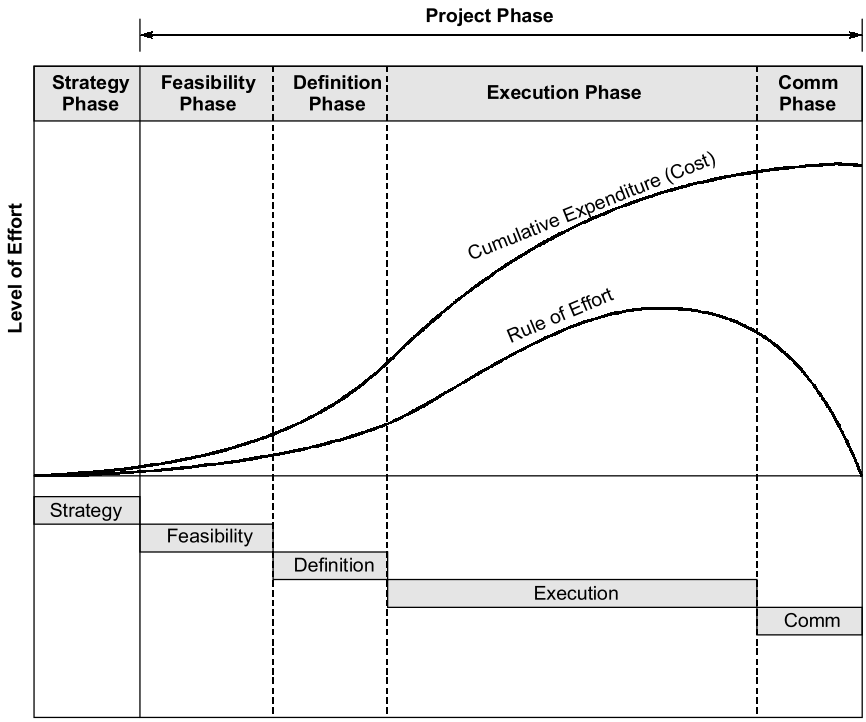


Fig. *Level of Effort*

The accumulated effort is the sum of the effort to date. This shows a typical 'S curve' profile similar to that used in the earned value calculation. This is a useful feature for the project manager to note as similar projects tend to have similar levels of effort profiles.

1.10 LEVEL OF INFLUENCE VS. COST OF CHANGES (FRONT-END IMPORTANCE)

'Cost of change' curve plotted against the project lifecycle.

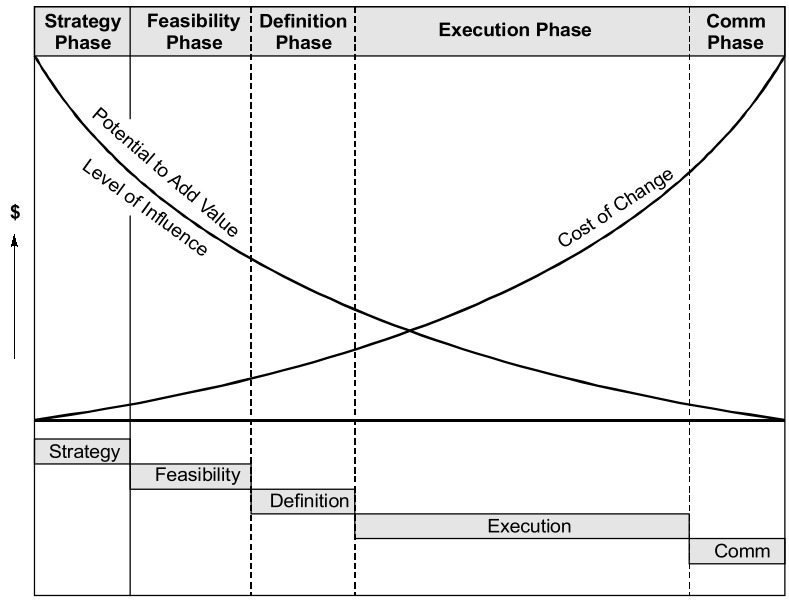


Fig. *Level of influence vs. Cost of change*

1.11 PRODUCT LIFE CYCLE

Products, like people, have life cycles. The product life cycle is broken into four stages: introduction, growth, maturity, and decline. This concept is used by management and by marketing professionals as a factor in deciding when it is appropriate to increase advertising, reduce prices, expand to new markets, or redesign packaging.

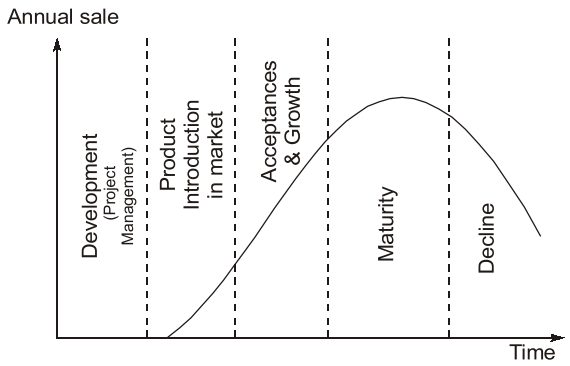


Fig. *Product Life Cycle*

What do the PLC stages mean?

Introduction: Introducing a new product where it's unknown and products are small. The price is often higher as distribution is limited and promotion is personalized.

Growth: Popularity for the product grown, meaning it is being bought in greater numbers and, with volume, the price declines. Distribution increases and promotion focuses on product benefits.

Maturity: The product competes with alternatives and its pricing drops. Distribution becomes intense (it's available everywhere) and promotion focuses on the differences to competitors' products.

Previous ESE Prelims Questions

Q.1 Consider the following statements regarding project management:

1. It is the process of attaining project objectives in a stipulated time to produce quantified and qualified deliverables
2. It is the art of bringing together the responsibilities, resources and people necessary to accomplish the business goals and objectives within the specified time limitations and within the financial grant

Which of the above statements is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

[ESE-2017]

Ans. (c)

Q.2 Consider the following phases of project management:

1. Identification 2. Formulation
3. Appraisal 4. Implementation

Which of the above phases are relevant, sequentially?

(a) 1, 2 and 3 only (b) 1, 2 and 4 only
(c) 3 and 4 only (d) 1, 2, 3 and 4

[ESE-2017]

Ans. (d)

Q.3 **Statement (I):** Project management is essentially the process to plan its implementation and to pre-determine the period-wise need of resources including funds and personnel, given the choice of total duration and quality standards.

Statement (II): Of the four dimensions (not denying that there can be some more) of a project. viz., scope, cost, time and quality, only any two can be pre-assigned; others have to abide by these two prescriptions.

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I).
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is **not** the correct explanation of Statement (I).
(c) Statement (I) is true but Statement (II) is false.
(d) Statement (I) is false but Statement (II) is true.

[ESE-2018]

Ans. (a)

Q.4 In progress of a project, the percentage of error will be less in

(a) Definitive cost estimate (b) Detailed estimate
(c) Preliminary estimate (d) Study estimate

[ESE-2019]

Ans. (b)

Q.5 In a project life cycle, the maximum percentage of effort is done in

(a) Concept phase (b) Definition phase
(c) Planning and organizing phase (d) Implementation phase

[ESE-2019]

Ans. (d)

Q.6 **Statement (I) :** All projects have constraints or limitations that inhibit their ability to reach goals and objectives.

Statement (II) : Time and money are universal constraints in projects.

(a) Both Statement (I) and Statement (II) are individually true; and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true; but Statement (II) is NOT the correct explanation of Statement (I)
(c) Statement (I) is true; but Statement (II) is false
(d) Statement (I) is false; but Statement (II) is true

[ESE-2019]

Ans. (a)

Objective Brain Teasers

Q.1 The steps or phases taken by the project from beginning to ending are collectively called its:
(a) Hierarchy of steps to be followed on the project
(b) The manager's method of completing the project
(c) The project Life Cycle
(d) A collaborative approach between the Manager and the team to complete the work on the project

Q.2 The project management process groups are:
(a) Initiating, planning, expediting, and control.
(b) Plan, organize, develop, and control.
(c) Plan, do, observe, commit.
(d) Initiating, planning, executing, monitoring, controlling, and closing.

Q.3 Ideally, a project manager should be selected and assigned at which point in the project life cycle?
(a) During the initiating process or conception stage
(b) During the project planning process
(c) At the end of the design phase of the project life cycle
(d) Prior to the beginning of the design phase of the project life cycle

Q.4 The second largest employment generating industry in the country is
(a) Agriculture
(b) Petro-chemical
(c) Construction Industry
(d) Leather Industry

Q.5 _____ recognizes that a project or phase should begin and commits the organization to do so:
(a) Initiating Process
(b) Solicitation Process
(c) Scoping Process
(d) Planning process

Q.6 Projects are initiated in the life of an organization as a result of:
(a) An immediate financial need
(b) To keep employees busy and productive
(c) To achieve a pre-set strategic objective
(d) To make products for sale in the market

Q.7 A collection of generally sequential project phases whose name and number are determined by the control needs of the organization or organizations involved in the project, is called:
(a) Project life cycle
(b) Product life cycle
(c) Portfolio management
(d) Program management

Q.8 In which of the following project management process groups, most of the time and money are typically spent?
(a) Initiating (b) Planning
(c) Executing (d) Controlling

Q.9 All of the following are characteristics of a project except: