

Project Management: Techniques and Methodologies

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Abstract: A project is a unique process that consists of a set of coordinated activities with start dates and end, with the aim of achieving an objective in accordance with specific requirements, including time, cost and resources. In order to achieve an objective, multiple skills are needed. A project, because of its peculiarities, its singularities, and its imponderables, never takes place in an ideal way unless a management of its different aspects is applied. The challenge that the project management faces is achieving all the project goals within a given constraints. These constraints are the scope of the project, the time available for the completion of the project, the quality of the final product, result or service, the budget dedicated to the progress of the project. Throughout the realization of a project and since its beginning, risks can arise and must be solved by adopting a well-defined approach to avoid the negative impact that a risk may have on the project. Several techniques must be used by a project manager in order to carry out his mission and carry out the project successfully and in good conditions.

Keywords: Project management, risks, scope management, deadlines, requirements, SMART

1. Introduction

A project is a set of coordinated actions requiring multiple skills and resources to achieve a goal. Each objective is autonomous, in the sense that there is a beginning and an end. The project is over when the end point is reached. A project can release a unique product, result or service, but can also improve an existing one. Projects vary in size, and this is an important factor that impacts the decision of the entity that will plan, organize and manage the project. Small projects can be managed by one individual whereas large projects, requires a competent staff, aware of the project requirements and how to manage the available resources. Many techniques and tools are available for a project manager to use, and to make the right decisions at the right moment in order to meet the requirements, respect the constraints and reach the end of the project successfully. There are numerous approaches for managing a project, and regardless of the approach used, the overall project objectives, deadlines, costs, scope, risks must be taken into consideration, as well as the roles and responsibilities of the clients and stakeholders.

2. The Main Constraints of a Project

2.1 Cost constraints

The cost of the project is the sum of the costs:

- Of the project's human resources
- Of the project's hardware and software resources

This cost obviously depends on the duration of the project. The cost management of the project includes processes related to cost planning, estimation, budgeting, financing, provisioning, management and cost control, so that the project can be completed within the approved budget.

Cost constraints encompass two types:

- Constraint of profitability: Margin between project reports and costs incurred.
- Constraint for the financial balance of the company.

The following figure gives an overview of a project's cost management processes.



Figure 1: Overview of a project's cost management processes

- **Plan cost management:** this process involves establishing internal policies, procedures and documentation for planning, management, expenditures and control of project costs.
- **Estimate the costs:** this process involves assessing the monetary resources required to carry out project activities.
- **Determine the budget:** this process consists of consolidating the estimated costs of each activity or each work package, in order to establish an approved cost base reference.
- **Master the costs:** this process consists of monitoring the status of the project in order to update project costs and manage changes affecting the base cost reference.

The cost management of the project focuses on the cost of the resources needed to complete the project activities. The cost management of the project must also take into account the effect of the project's decisions on the subsequent recurrent costs of using, maintaining and supporting the product, service or result of the project.

2.2 Quality Constraints

Strong constraints. Their non-compliance is likely to affect in a negative way the whole project. The quality management of the project includes the processes and activities of the implementing organization that determine the quality policy, objectives and responsibilities, so that the project meets the needs for which it was undertaken. Project quality management applies policies and procedures throughout the project and supports ongoing process improvement activities on behalf of the implementing organization, as required. The quality management of the project ensures that project requirements, including product requirements, are met and validated.

The following figure shows an overview of the quality management processes of project.



Figure 2: Overview of the quality management processes of a project

- **Plan quality management:** this process involves identifying the quality requirements and standards to be met for the project and its deliverables and documenting how the project will demonstrate compliance with appropriate requirements and quality standards.
- **Implement quality insurance:** this process involves auditing the quality requirements and results of quality control measures to ensure that the project is using the appropriate quality standards and operational definitions.
- **Implement quality control:** this process involves monitoring and recording the results of quality-related activities to assess performance, and recommending necessary changes.

2.3 Time constraints

Time frame within which the project must be carried out. There are two types of time constraints:

a) Absolute external constraints:

External to the project and are generally imposed. If it is not respected, the project no longer has any meaning.

b) Constraints due to customers:

- External "fixed" constraint: It is often contractual, it is often accompanied by an off delay penalty.
- External "variable" constraint: It concerns the realization of a part of the project which is linked to an event whose date is not absolutely fixed.

The following figure gives an overview of a project's time management processes.



Figure 3: Overview of a project's time management processes

- **Plan the schedule management:** this process involves establishing internal policies, procedures and documentation for the planning, development, management, execution and control of the project timeline.
- **Define activities:** this process involves identifying and documenting specific actions to be undertaken to produce project deliverables.
- **Organize activities in sequence:** this process involves identifying and documenting the relationships between project activities.
- **Estimate resource requirements for activities:** this process involves estimating the profile and number of human resources, the type and quantity of materials, equipment or supplies needed to carry out each activity.
- **Estimate the duration of activities:** this process involves estimating the number of work periods required to complete each activity with estimated resources.
- **Develop the timeline:** this process involves developing the project timeline model based on sequencing analyzes, time frames, resource requirements, and timeline constraints.
- **Master the timetable:** this process consists of monitoring the status of project activities to update progress and manage changes affecting the baseline of the schedule in order to implement the plan.

3. Project Management Phases

Any project can be divided into four phases.

A project life-cycle consists of four phases that are: initiation, planning, execution and closure. [1]

Each phase requires different skills, tools and resources.

Each one presents its own risks and constraints, which must be managed and respected in order to achieve the project objective by the time of reaching the closure phase.

The following figure shows the phases that a project goes through.

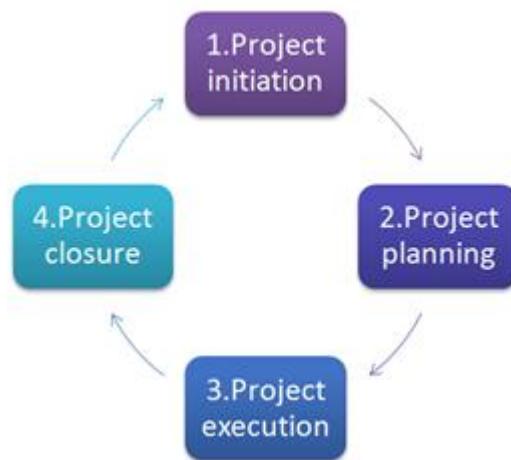


Figure 4: Project life-cycle

- a) **Project initiation:** It's the first phase of a project. The determination of the purpose of the project takes place in this phase. An estimation of resources, costs and timeframes must be done. In this phase the type of organization must be defined and a project manager must be assigned. Estimation of risks and profitability are also done during this phase.
- b) **Project planning:** In this phase, the scope had already been defined, and the project enters this phase that involves:
 - Global planning
 - Details of costs and deadlines
 - Highlighting potential risks
 - Acceptance plan
 - Quality plan
 - Resource plan
- c) **Project execution:** This phase implements the plans defined and created during the planning phase. This includes:
 - Setting up the organization
 - Performing the work
 - Reviewing deliverables
 - Problems solving
- d) **Project closure:** This is last phase of a project life-cycle and it involves:
 - Analysis of the gaps between planned and achieved.
 - Project evaluation.
 - Reassignment of the staff
 - Handing over the project documentation to the business.
 - Communicating the project closure to the stakeholders.

The following graph shows the variance of the level of risk, uncertainty, stakeholder influence, projects costs and cost of changes during the course of a typical project life cycle.

At the beginning of the project, the level of risks and uncertainty is very high and gradually decrease over time. The farther the project team gets along the way, the more the uncertainty decrease, and the risk points are passed. The initiation and planning phases are the first two phases and they are important because it's the phases where the influence of the stakeholders is at its peak. Their ability to influence the project decreases at the end of the project and this is due to the cost of changes that are in high level toward the end of the project. [3]

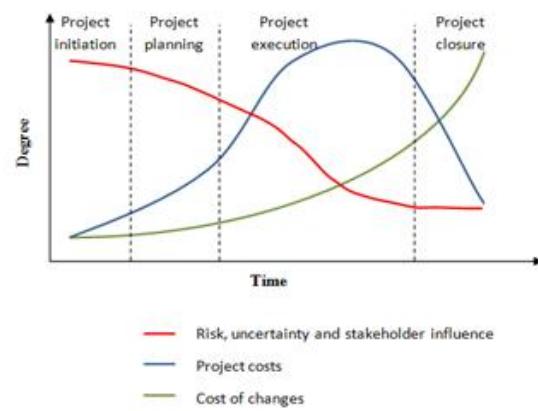


Figure 5: Different trends over time

4. Project Planification

Some projects end beyond deadlines and others exceed budgets. This is why a method of forecasting realistic deadlines and realistic costs is needed. The main objective of planification is to estimate the time required to complete each task.

It involves the determination of:

- Total duration of the project
- Date of termination
- Human and material resource requirements

The planification is a necessary task because it is a basis, required for the determination of the duration of the project and the commitment of human and material resources.

There are many methods of planification:

- Similar activities
- Historical data
- Delphi method
- Three-point estimation
- Wide Brand Delphi Technique

4.1 Similar Activities

This technique is generally based on memory or discussions. If a project activity P1 is similar to activities carried out in Pi projects then the duration of activity of P1 is identical or extrapolated from similar activities Of Pi.

4.2 Historical Data

This technique consists of a systematic recording, during and at the end of projects, and results in information on the duration of tasks. Historical data assumes the existence of databases that are internal or external to the company.

4.3 Delphi method

Used to improve the quality of the estimation in the absence of experts. It's a group method and a set of individual estimates. The result's histogram must be presented to the group and external participants explain their vision.

4.4 Three-point estimation

The duration is considered as a random variable. It is a group method. The steps for applying this method are as follows:

- The estimator selects people with a good knowledge of the subject.
- They are asked to provide their estimates individually.
- Once the answers are collected, the estimator determines the most pessimistic estimate "P", the most optimistic "O" and finally the most likely "M" (that is provided by the majority of participants).
 - M: working under normal conditions.
 - O: ideal conditions, no obstacles, minimum time to complete the task.
 - P: maximum time to complete the task in the worst conditions.

By using the three-point estimation method, the result isn't an exact duration, but the probability of the different durations.

$$\text{Average duration estimate} = \frac{O+M+P}{3}$$

PERT is a type of three-point estimation technique. Program Evaluation and Review Technique (PERT) uses the value of the most likely four times.

$$\text{PERT duration estimate} = \frac{O+4M+P}{6}$$

4.5 Wide Brand Delphi Technique

This technique is a combination of the three-point estimation method and Delphi method. It consists of individual estimates of O, M and P, the results are then compiled and the extremes are eliminated.

5. The Fundamentals of Project Management

5.1 The project charter

Document issued by the initiator or the project sponsor, which formally authorizes existence and gives the authority to the project manager to assign resources of the organization to the project's activities. [3]

The project charter identifies, defines and describes:

- Partners and stakeholders.
- The management framework to be applied.
- Roles, responsibilities and activities of the main members of the team.
- Communication and control mechanisms.

Generally, the project charter will not change during the life cycle of the project. It is established at the beginning of the project, approved by key stakeholders and can be consulted throughout the project.

It is the project manager who must ensure that the charter is drawn up and duly approved.

5.2 The Scope Statement

It is a narrative description of the project's content, including the main deliverables, assumptions and constraints of the project, as well as a description of the work. [4]

For stakeholders, the scope statement, defines the needs to which the project must respond, project's objectives, the stakeholder's obligations, tangible results or expected deliverables, exclusions, success indicators as well as the management and control of the project.

It consists of describing in the most succinct way, but also the most accurate and complete way, the needs to which the project must respond.

The formulation of objectives is one of the key elements of a project's success

The formulated objectives, responds to the needs that have been previously described. The formulation of the project's objectives should be guided by SMART methodology. The objectives must therefore be:

- S: Specific
- M: Measurable
- A: Achievable
- R: Relevant
- T: Timely

-Specific: Goals should be specific, why the budget is required and how it will be managed and used.

-Measurable: Objectives should be framed within metrics like date of completion.

-Achievable: The idea of the project must be realistic and attainable-appropriate level of challenge.

-Relevant: Objectives should be realistic so they can be accomplished.

-Timely: There must be a deadline for reaching the goals. Objectives should have start and end date.

6. Conclusion

In this work, a project had been defined as a set of coordinated actions requiring multiple skills and resources to achieve a goal. A project must be managed based on different techniques and methodologies in order to meet the fixed objectives respond to the requirements and use the available resources effectively. Many processes are involved in the field of project management. These processes can be organized into different functional areas such as managing the scope, schedule, human resources, risk, etc. These functional areas will be discussed in details in the future works.

References

- [1] Jason Westland, The Project Management Life Cycle, Kogan Page, United Kingdom, 2006
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