Chapter 5

Project Planning.
Project Scope.
Work Breakdown Structure.

Objectives

- Acquire a general understanding of the parts of the project management plan
- Understand the importance of discovering and documenting stakeholder requirements
- Understand how to create a detailed scope statement and work breakdown structure (WBS)
- Learn how to match the right person, with the needed skill set, to the appropriate activity
Project Planning. Integration Management KA.

Project Planning starts with the Project Plan Development process, which is a part of the Integration Management knowledge area.

The single deliverable from this process is the Project Management Plan – a consistent coherent document; it consists of deliverables for each of the other 8 Knowledge Areas (KAs).

*Project Plan = Telling the team “WHAT TO DO”*

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**Project Management Plan: Main Components**

- Scope management plan (Chapter 5) Lab 1
- Work breakdown structure (WBS) (Chapter 5) Lab 1
- Human Resource management plan (Chapter 5) Lab 1
- Time (schedule) management plan (Chapter 6) Lab 2
- Cost management plan (Chapter 6) Lab 2
- Quality management plan (Chapter 7) Lab 3
- Process improvement plan (Chapter 7) Lab 3
- Communication management plan (Chapter 7)
- Risk management plan (Chapter 8) Lab 4
- Procurement management plan (Chapter 9) Lab 4

Many organizations not only have documented business templates for each part of the plan to speed up development of the plan and to maintain consistency across projects but also may have slightly different standard formats, based on different project characteristics, such as size, complexity, length, and risk level.

For example, a small, low-risk project would have a shorter and less formal project planning document than a large, complex project with members of the project team spread out all over the world.
Attributes of Good Project Plans

- Plans should be **dynamic**
- Plans should be **flexible**
  Things always happen during the project to change each of these four constraints so plans should be built to accommodate room for issues/problems/delays.
- Plans should be **updated as changes occur** (Integrated Change Control)
- Plans should first and foremost **guide project execution**
- Plans should **never** assume the team will **work overtime**, at least not at the start
  
  Assuming that the only way to hit the project plan objectives for 1) scope, 2) time, 3) cost, and 4) quality is to schedule over time at the very beginning is a sure recipe for disaster.

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What the main reason to create Project Plan?
The answer: Project Cost and Project Time

- The **Cost of Software Change Law** is a very well-known law (see on the right).
- Errors found “upstream” during the planning phase cost on the order of 200 times less to fix than errors found “downstream” during the building of the product.
- Planning “forecasting”, “seeing into the future” is not an easy task
- T. Capers Jones (1998) summed it up this way: “The seeds of major software disasters are usually shown in the first three months of commencing the software project. Hasty scheduling, irrational commitments, unprofessional estimating techniques, carelessness of the project management function are the factors that tend to introduce terminal problems.”

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<table>
<thead>
<tr>
<th>The Cost of SW Change</th>
<th>Definition</th>
<th>Development</th>
<th>After release</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x</td>
<td>1.5-6x</td>
<td>60-100x</td>
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Project Plan Creation and *Analysis Paralysis*

- Although planning is crucial, project teams must be careful to avoid over-planning.

- The project planning must be appropriate to the size, complexity, and risk of the project (small and easy projects -> small planning; large and complex projects -> significant planning efforts).

- Project managers must be careful to avoid what is known as *analysis paralysis* -- getting stuck in the analysis phase, trying to get everything defined perfectly.

_in software development, analysis paralysis typically manifests itself through exceedingly long phases of project planning, requirements gathering, program design and data modeling, with little or no extra value created by those steps. When extended over too long a timeframe, such processes tend to emphasize the organizational (i.e., bureaucratic) aspect of the software project, while detracting from its functional (value-creating) portion._

Analysis paralysis often occurs due to the lack of experience on the part of business systems analysts, project managers or software developers, as well as a rigid and formal organizational culture.

Analysis paralysis is an example of an anti-pattern. Agile software development methodologies explicitly seek to prevent analysis paralysis by promoting an iterative work cycle that emphasizes working products over product specifications.

CS590 "SE" vs. CS593 "SE of WebApp" courses

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From Integration Management KA to Scope Management KA

Scope Management consists of 3 processes:

1. Collect Requirements
2. Define Scope
3. Create WBS (Work Breakdown Structure)
SW Requirements Engineering

A requirement is a singular documented need of what a particular product or service should be or perform. It is a statement that identifies a necessary attribute, capability, function, characteristic, or quality of a system in order for it to have value and utility to a user.

1) Business requirements describe in business terms **WHAT** must be delivered or accomplished to provide value.

2) Product requirements describe **properties, functions and attributes** of a system or product (which could be one of several ways to accomplish a set business requirements.)

3) Process requirements describe **HOW** activities performed by the developing organization (methodologies to be followed, and constraints that the organization must obey.

Main topics (or, components) *):
- Functional and nonfunctional system requirements
- Business rules
- Impacts on any other systems and/or departments
- Support and training requirements
- Acceptance criteria for each requirement or set of requirements
- Quality requirements

*) Multiple details are available in CS 592 course

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**SW Requirements: An Example**

Microsoft Office 2010 system requirements

- Processor: Intel 4th generation Core i3/i5/i7, or AMD equivalent
- Memory: 4 GB RAM (32-bit) or 8 GB RAM (64-bit)
- Hard disk: 20 GB available space
- Operating system: Windows 7, Windows 8, or Windows Server 2008 R2
- Internet connection:

Scope Statement

**Scope** refers to all (100%) of the work involved in creating the products of the project and the processes used to create them.

**Scope statement** describes the characteristics of the product that the project was created to deliver.

Scope statements may take many forms depending on the type of project being implemented and the nature of the organization. However, a baseline scope statement should contain:

- The project name
- The project owner, sponsors, and stakeholders
- The project charter (roles and responsibilities, identities of stakeholders, etc.)
- The problem statement
- The project goals and objectives
- The project requirements
- The project deliverables
- The project non-goals (what is out of scope)
- Milestones (timetable, schedule)
- Cost estimates


Work Breakdown Structure (WBS)

- **Work breakdown structure (WBS)** is a method used to define group of project’s discrete work elements in a way that helps organize and define the total work scope of the project.

- **WBS element** may be a task, a product, data, a component, a service, or any combination of these elements.

100% rule:

- The WBS represents 100 percent of the work required to produce the final products, and, therefore,
- All tasks must add up to 100% of the total scope and should not go over 100% (No “I forgot to add …” statements at all after project WBS has been approved)
Main idea: to break the entire project into manageable and quantifiable components (tasks)

Building the WBS

Various approaches can be used to build the WBS:

1. **Analogy approach**: A WBS is first created by looking for a similar projects done in the past and using its WBS as a starting point. SE Design Concept: “Do NOT reinvent the wheel” (check web sites of similar projects)

2. **Top-down approach**: Start with the largest items of the project and keep breaking them down into smaller and smaller parts

3. **Bottom-up approach**: Start with the detailed tasks and roll them up

4. **Thread-based approach**: Concentrate on most important items first

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*Using guidelines:*

Some organizations, like the DoD, National Science Foundation (NSF) provide guidelines/requirements for preparing a WBS.
Be a professional: be able to generate a list of advantages and weaknesses (potential problems) of any idea, approach, method, technique, SW, etc.

SWOT analysis: Strengths – Weaknesses – Opportunities - Threats

The analogy approach: a sample
**Analyze Analogy Approach: Advantages and Issues**

**Advantages:**
- Is the fastest path to a completed WBS
- Is a valuable tool for brainstorming a new project and looking for deliverables
- Enhances cross-project consistency
- Improves budget and time estimates
- Improves resource allocations

**Issues:**
- Ensure that the previous WBS is completely understood and similar
- Ensure the previous WBS is accurate and updated
- Critically review the previous WBS and its appropriateness for the new project

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**Top-Down Approach: Advantages and Issues**

**Advantages:**
- Ensures projects are organized logically based on the nature of the project
- Promotes stakeholder participation in the planning phase of the project
- Can create a greater understanding of the entire project by all participants

**Issues:**
- Need to make sure major objectives are not forgotten
- Make sure to decompose the tasks to appropriate levels
- Can be time consuming, must guard against “analysis paralysis”
- Cost and time estimates are more difficult to create and generally less accurate than under the analogy approach
Bottom-Up Approach: Advantages and Issues

Advantages
- May lead to a more complete list of tasks and detailed description of tasks
- Promotes participation of various stakeholders in the planning phase of the project
- Can create a greater understanding of the entire project by all participants

Issues
- Difficult to retain focus on the “big picture”
- Need to make sure major objectives are not forgotten
- Harder to get organized into logical steps or phases

Thread Approach: Advantages and Issues

Advantages
- Generally the most important stakeholder objectives done first
- Greater control and focus of the brainstorming sessions
- Promotes stakeholder participation in the planning phase of the project
- Can create a greater understanding of the entire project by all participants

Issues
- Make sure to not lose focus of the “big picture”
- May lose site of the effect one objective may have on another
- Increases the need for communication
- More successful when the project leader and team has a good understanding of the project’s objectives
Which Approach to Choose?
Some recommendations …

- **In case of the existence of a similar project:**
  would lead you to the analogy approach which if done correctly is the fastest and most accurate method

- **In case of an evolutionary type of project:**
  depends on experience level of the project manager and team:
  - if little experience, choose the top-down approach;
  - if many years of experience then choose a bottom-up approach

- **In case of a revolutionary type of project:**
  - if the product or process is very unique, never anything like it before in this company or by this team then choose the top-down approach

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**WBS Structure Example: Hierarchical Design-Based Form**

**Webster Software System -- A Hierarchical Design Model**

(system, subsystems, and component design)

```
System Level
(Webster System)

Level of Subsystems (Domains)
(Databases, GUI, Security, HELP, etc.)

Level of Elements or Components
(tables, forms, queries, reports, macros and modules, …)

Level of Sub-elements, Details
(for ex., attributes)
(ID, First Name, Last Name, DOB, YOA, status, …)
```
WBS Example: Decision Tree-Based Form

WBS Example: GUI Hierarchical Design Model
WBS Examples: Process-Based Form

WBS Example: Tabular Form
(to be used in CS591 Lab 1, and CS591 Lab 2)
Basic Principles for Creating a WBS

- **The WBS represents 100% of the work** required to produce the product. As soon as you define more than 100% of the scope, you have committed to doing more than you agreed to - scope creep has begun (100% Rule)
- **Each WBS element represents a single deliverable**
- Each deliverable is distinct
- **Accountability for each task can be assigned to one team member**
- Not all elements of the WBS need to be decomposed to the same depth
- Have all **reporting and control mechanisms** been included
- Be prepared for changes

Dictionary:
- **Control accounts** – accounting or finance department assigned account codes used in the accounting system to track costs
- **Statement of work** – describing the details of the work involved in creating each deliverable
- **Responsible organization** – who is responsible for each deliverable
- **Schedule for major milestones**
- **Contract information if outside vendor involved**
- **Quality requirements**
- **Estimate of cost and resources required**

Chapter 5.

Project Planning.
Project Scope.
Additional (optional) information.
Project Management Plan: A Development Process Guidelines

- A project plan is a document used to coordinate all project planning documents.
- Its main purpose is to guide project execution.
- Project plans assist the project manager in leading the project team and assessing project status.
- Project performance should be measured against a baseline project plan.
- Building the plan should not be done in secret or in isolation; the whole project team needs to participate.

SW Project Plan and SW Analysis Paralysis

## What Is Project Scope?

- **Scope** - refers to all (100%) of the work involved in creating the products of the project and the processes used to create them.

- A **deliverable** - is a particular product produced as part of a project, such as hardware or software, planning documents, or meeting minutes.

- A **scope management plan** describes how the project team will:
  - define the scope,
  - develop the detailed scope statement,
  - define and develop the work breakdown structure (WBS),
  - verify the scope, and
  - control the scope.

- A **scope statement** describes the characteristics of the product that the project was created to deliver.

### Scope Statement Depends on:

1. Project **size**, including the number of people, dollar value, duration, and geographic span.
2. Degree of **risk** to the business.
3. **Cash requirements**, such as length of time for return on investment and initial cash requirements.
4. **Technology** utilized (for example, maturity, experience of current staff).
5. **Project team experience** with technology, business, and industry.
6. **Nature of the deliverables**, such as whether this is a new product or service, an upgrade, or a repair.
7. **Strategic importance** of the project to the organization.
8. **Project definition** (for example, whether the requirements are undefined, partially defined, or poorly defined).