Excellence in Financial Management

Course 19: Managing Projects

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This course provides an overview of project management, including the project life cycle and project control documents. This course is recommended for 2 hours of Continuing Professional Education. If you are seeking credit for taking this course, then you need to download and use the "exe" file version of this course. All course files and supplemental materials are posted on the internet at www.exinfm.com/training

Chapter
1

The Framework for Project Management

Increasingly, organizations are driven by project related work as opposed to functional type work. The repetitive functions, things like payroll, accounting, and public relations, are becoming outsourced so that people can devote more time to the real value added work of projects. The need to change is driving much of this shift away from functional work to project work. And this can range from process improvement type projects (such as Six Sigma) to short term projects such as competitive analysis profiles. Given this increased emphasis on project related work, it is now important for everyone to fully understand how to manage projects. This short course will present the principles and practices associated with project management.

> "Projects are often viewed as being fundamentally rooted in technology. This is because most projects are technical. Unfortunately, this orientation toward technology has obscured the true purpose of projects. The truth is that projects are all about business – not technology. The fundamental objective for a project is to achieve a business result, such as improving effectiveness, increasing sales, or making operations more efficient. No matter what that underlying cause, the ultimate purpose of a project is very simple: to make money or to save money."
> – Brief Case Books – Project Management by Gary R. Heerkens, PMP

Project Management Body of Knowledge (PMBOK)

Because of the importance of projects, the discipline of project management has evolved into a working body of knowledge known as PMBOK - Project Management Body of Knowledge. The Project Management Institute or PMI (www.pmi.org) is responsible for developing and promoting PMBOK. PMI also administers a professional certification program for project mangers – Project Management Professional or PMP. So if you want to get grounded into project management, PMBOK is the place to start and if you want to make project management your profession, then you should consider becoming a PMP.

So what is PMBOK? PMBOK is the fundamental knowledge you need for managing a project, categorized into nine knowledge areas:

1. Managing Integration: Projects have all types of activities going on and there is a need to keep the "whole" thing moving collectively together – integrating all of the dynamics that take place.
2. Managing Scope: Projects need to have a defined parameter or scope and this must be broken down and managed through something called a Work Breakdown Structure or WBS.
3. Managing Time / Schedule: Projects have a definite beginning and a definite ending date. Therefore, there is a need to manage the budgeted time according to a project schedule.

4. Managing Costs: Projects consume resources and therefore, there is a need to manage the investment with the realization of creating value; i.e. the benefits derived exceed the amount spent.
5. Managing Quality: Projects involve specific deliverables or work products. These deliverables need to meet project objectives and performance standards.
6. Managing Human Resources: Projects consist of teams and you need to manage project team(s) during the life cycle of the project. Finding the right people, managing their outputs, and keeping them on schedule is a big part of managing a project.
7. Managing Communication: Projects invariably touch lots of people, not just the end users (customers) who benefit directly from the project outcomes. This can include project participants, managers who oversee the project, and external stakeholders who have an interest in the success of the project.
8. Managing Risk: Projects are a discovery driven process, often uncovering new customer needs and identifying critical issues not previously disclosed. Projects also encounter unexpected events, such as project team members resign, budgeted resources are suddenly changed, the organization becomes unstable, and newer technologies are introduced. There is a real need to properly identify various risks and manage these risks.
9. Managing Procurement: Projects will procure the services of outside vendors and contractors, including the purchase of equipment. There is a need to manage how vendors are selected and managed within the project life cycle.

This is the big framework for managing projects and if you want to be effective in managing projects, then you need to be effective in managing each of the nine knowledge areas that makeup PMBOK. Chapter 2 of this short course will cover each of these nine areas in greater detail.

> "Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. Project management is accomplished through the application and integration of project management processes of initiating, planning, executing, monitoring and controlling, and closing. The project manager is the person responsible for accomplishing the project objectives."
> – A Guide to Project Management Body of Knowledge (PMBOK Guide) by Project Management Institute

The Project Life Cycle

Unlike repetitive functional type work, projects have a clear beginning, middle and end to the work that must get done. This work is expressed in terms of the life cycle, consisting of six phases:

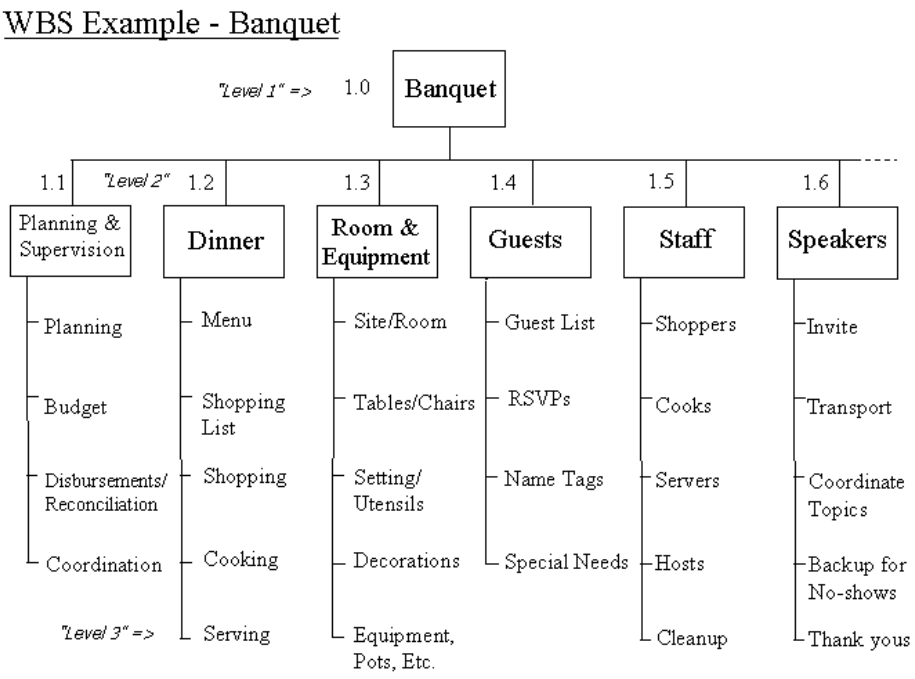
1. **Initiate**: This is where we begin – trying to nail down what this project is about and how it will positively impact our company. During this initial stage of the project, we must define the scope of the project – major project objectives and deliverables to be addressed by the project. As a preliminary step, we might develop and circulate a

Concept Paper to senior leadership, asking them to approve or deny the justification behind this project. If the Concept Paper is approved, we might do a formal *Business Case*, outlining how this project will meet a critical business need, including the costs and benefits associated with the project.

Concept Paper	Business Case
Very short and brief, less than 5 pages	Much more extensive, tells a complete story about the problems, possible solutions and recommended approach
Describes the overall goal of the project	Assesses the complete situation, develops different alternatives, and explains how the problem can best be solved.
Describes how the end results of the project will impact the organization	Addresses different performance areas, including implementation, time frame, risks, assumptions and other issues
May want to include references to substantiate or support your idea	Requires a Cost Benefit Analysis of each alternative with recommendations
Concept Paper should be approved by Senior Management before committing resources to prepare the Business Case	Business Case is prepared once Senior Management wants to proceed past the conceptual idea stage

If management gives the green light and agrees to fund the project, then we need to line-up a project team and formalize the project scope. This is documented through something called a *Project Charter*. Project Charters are the first real document to set a project into motion, authorizing the project team to move forward and get started. The Project Charter outlines the major steps and deliverables of the project, including the core team members. Project Charters are signed by senior level managers who serve as sponsors of the project.

2. **Plan**: Now that we've initiated the project through a Project Charter, we have to develop a detail project plan for executing the goals and objectives documented in the Project Charter. In order to prepare a detail project plan, you start by breaking down the project scope into activities or work elements. This is accomplished by setting up a *Work Breakdown Structure* (WBS). The WBS is a multi-level structure that breaks all of the project work down into work packages and each work package has a work product, deliverable, or some milestone that allows us to measure the output associated with the work package.



Source: www.hyperthot.com

Once we have organized all project work into the WBS, we quantify the work in terms of costs (how much do we expect to spend on each work package) and schedule (how long will it take us to complete each work package). And if we can accurately assign a measurable milestone to each work package, the combination of all quantified work packages (costs, time, and milestones) forms the *Performance Measurement Baseline* (PMB). This is the detail project plan we will use to manage the project going forward.

3. **Execute**: Now that we have a detail plan in place in the form of a Performance Measurement Baseline, it's time to execute – assign the work packages to sub-teams and groups. Most of these smaller groups will have "subject matter expertise" in different areas. In our WBS Example for the Banquet, we have cooks, servers, and waiters each assigned to do different things. Each is a SME (subject matter expert) for getting their piece of the project done.

For large scale projects, we may want to develop and use some supplemental plans:

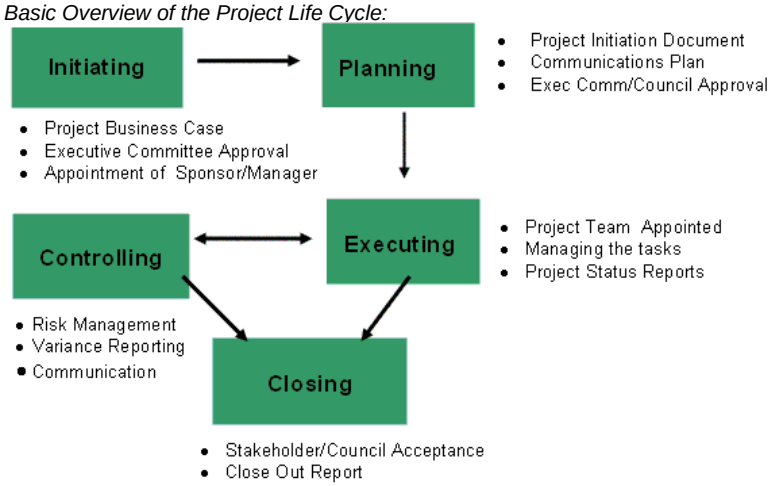
- Project Management Plan – Serves as the master planning document for the project, describing the major activities and processes that must take place, who will do the work, and all key deliverables and work products. Unlike the Project Charter which is relatively brief and high level in nature, the Project Management Plan is more comprehensive, providing a road map of how the project will get done. It often includes several other planning documents, such as the Quality Control Plan and the Risk Management Plan.

- Quality Control Plan – A plan for describing how the project measures, monitors, and manages quality in various work products, project activities and processes. This includes establishing standards for quality, such as acceptance criteria. For example, a third party that is independent of the project may be asked to conduct an Independent Verification and Validation (IV&V) regarding the quality of work products, especially new software applications.
- Risk Management Plan – A plan that describes the risk management process, such as how the project goes about identifying, analyzing, and controlling project risk. The Risk Management Plan identifies how often risk assessments are done, who is responsible, and any tools and templates that are used.
- Communications Plan – A plan for organizing how communication works, such as the mediums that will be used (email, meetings, formal status reports, etc.) and identification of all stakeholders where communication is required.

4. **Control**: As we execute our project plan, we need to regularly review our performance to see how close we are to our project plan. For control purposes, the project plan is expressed in the form of a time-phased budget known as the Performance Measurement Baseline. And as actual costs accumulate, we can monitor progress. For example, if we go back to the WBS Example – Banquet, at the lowest level (level 3) within our Banquet WBS, we have everyone (cooks, servers, waiters, etc.) charge their time, apply an hourly rate to arrive at costs, and compare the actual costs to what's planned within the Performance Measurement Baseline. This is how we monitor and control the project. Chapter 4 will explore this concept in greater depth when we cover Earned Value Management.

5. **Close**: We've completed all deliverables outlined in the PMB and it's now time to close-out the project. This can include things like making sure all work products have been delivered and approved or making sure all of our project files and records are up to date. In the banquet example, we would make sure everyone has been paid, the banquet facility is clean and back to normal, and all funds raised by the banquet have been accounted for.

Basic Overview of the Project Life Cycle:



Source: www.internetnz.net.nz

Now that we understand the framework for managing projects, let's move forward to complete our understanding of project management as follows:

Chapter 2 - Understand each of the nine knowledge areas including the resources and outputs associated with each.

Chapter 3 – Understand the nuts and bolts behind how managers work through their projects.

Chapter 4 - Understand how we measure and monitor progress in terms of costs and scheduling using Earned Value Management.

Chapter 5 – Discuss some advanced topics such as managing multiple projects through portfolio management and Centers of Excellence.

> "The success or failure of any project often hinges on how well the project sponsor – the person who funds the project and ensures that desired benefits are achieved – relates to the project, the project manager, and other stakeholders. However, executives who are assigned as project sponsors often have little if any experience understanding their roles and responsibilities during the project lifecycle. Problems in communication and execution are inevitable as long as senior managers and project managers do not understand the mechanics of their relationship."
>
> – Project Sponsorship: Achieving Management Commitment for Project Success by Randall L. Englund and Alfonso Bucero

Chapter

2

The Disciplines of Project Management

In the opening chapter, we briefly highlighted the nine management areas that comprise PMBOK. We also noted that a project has five phases to its life cycle. This information can be summarized into the following PMBOK model:

Source: www.portfolio-engineering.com

Project Scope Management

Let's start with a fundamental question – deciding what work should and should not be part of the project. This question is critical at the project outset, but continues as we discover new requirements during the life cycle of the project. Scope represents all of the project work and since this is subject to change, managing project scope can be very challenging.

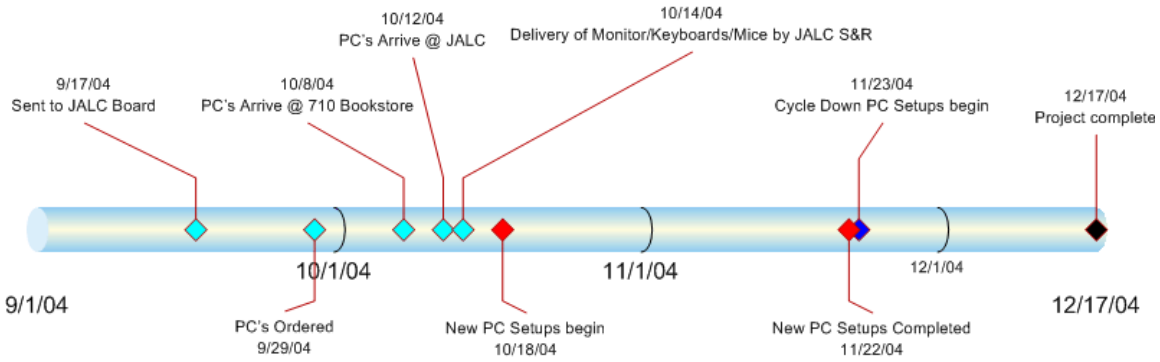
Scope is first defined in the Project Charter. So the more precise you are in defining the work, the more likely you can operate within your scope and avoid scope creep (growth in work beyond the original scope). If we look beyond the Project Charter, then scope gets defined by the work products. For example, projects create all types of outputs or products: User Requirements, Gap Analysis, Design Document, Training Manual, and Implementation Plan. These products give clear definition to the real work that must get done. The work that goes into producing work products is how you define the scope.

One way to manage the scope of a project is to make sure everyone understands what the goals and objectives of the project are, including project deliverables. A formal Scope Statement is sometimes used to remove ambiguities and define how changes will get approved. For example, many projects are driven by user related requirements and it is extremely difficult to identify all requirements early in the project life cycle. Therefore, some changes to the scheduled work are bound to happen. However, there needs to be a change control process for managing changes to the project scope, otherwise the project can get over-whelmed and execution becomes very difficult. Finally, don't forget to incorporate some cushion and flexibility into your project plan, allowing for some changes.

Project Time Management

In addition to managing project scope, we have to manage our project schedule; i.e. when the work is expected to be completed. Scheduling looks at how much time is available and allocates this time to the work (as defined by the Work Breakdown Structure). Therefore, the discipline of project time management has a lot to do with managing your project schedule – knowing how best to use your time for getting the work done on or before its scheduled completion date.

Example of scheduling important events over a timeline – keeps the Project Team focused



Source: www.jalc.edu

Everyone assigned to the project will need to manage their time. This can include simple things like using a To Do List or an Action Plan to stay focused on short-term tasks. It also includes knowing when to seek counsel or training to get unstuck. And there are numerous techniques to help manage time – setting priorities, communicating expectations, taking breaks to refresh, collaborating with team members, validating your results early-on, and not over-committing (promise low / deliver high).

> "The schedule should provide a variety of ways of measuring success as you monitor your project. You will start off with your baseline, which will be your initial project schedule for a specified time. This baseline schedule remains fixed and is used for comparison against your current project schedule. Baseline dates are, therefore, the initial dates for starting and finishing a task. These will be used with your current schedule for comparison purposes to see if tasks are being performed on schedule. This can also be used to calculate where your project costs are in conjunction with the budget."
> – The Everything Project Management Book by Rich Mintzer

Project Cost Management

Projects consume resources and resources have costs – people assigned to work on the project, facilities and equipment used by the project, and other direct costs. Projects should also recognize indirect costs; i.e. receiving benefits from resources without a direct association between the resource and the project. For example, projects may benefit from administrative support or the use of common facilities without incurring a direct charge to the project. We need to account for all resources consumed by the project, both direct and indirect. As we incur actual costs, we need to accumulate and compare costs to the budget. Therefore, a process and system should be in place for capturing and reporting our project costs.

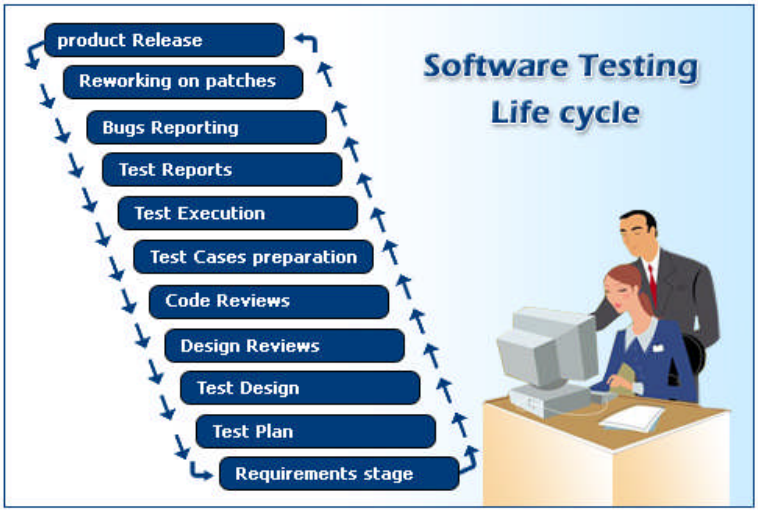
Monthly Project Cost Report
May 31, 2006
Project ID: 65-C112
Project Name: CRM Portal

Trans Date	Tran Code	Vendor Name	Expense Type	WBS Charge Code	Amount
5/3/06	AP	Inter Global	Contract Labor	2.3.3	8,079.30
5/12/06	AP	S I M C	Contract Labor	2.4.1	11,880.00
5/17/06	AP	Carson PMC	Contract Labor	2.4.2	6.950.00
5/21/06	EC	Taylor Miller	Training	2.4.3	2,070.00
5/29/06	EV	J. Smith	Travel Expense	2.4.4	3,120.50
			Total Monthly Costs		32,099.80

Project Quality Management

Projects produce lots of different outputs and products, ranging from a Project Charter and Project Plan early in the project life cycle to formal software testing and user training near the end of the life cycle. And all of these work products need to meet an acceptable level of quality, typically defined by the customer. A Quality Management Plan is used to communicate how you will go about evaluating and ensuring what you produce is really high quality. For example, it is usually necessary to have others review the quality of your work – Team Lead, Project Manager, or Customer. It is also important to compare your work against external standards. For example, different associations such as the Software Engineering Institute (SEI), International Organization for Standardization (ISO), and the Institute of Electrical and Electronics Engineers (IEEE) publish standards which are useful for benchmarking the quality of your work products.

It's worth noting that a low emphasis on quality will invariably impact project performance - cost over-runs, behind schedule, and dissatisfied customers. When you fail to meet or exceed expectations, this requires going back and doing things over again. So it is important to use a lot of quality control tools in project management – things like checklists, peer reviews, inspections, audits, testing, prototype models, walk throughs, metrics, variances, and acceptance criteria. Quality needs to be embedded into everything you do.

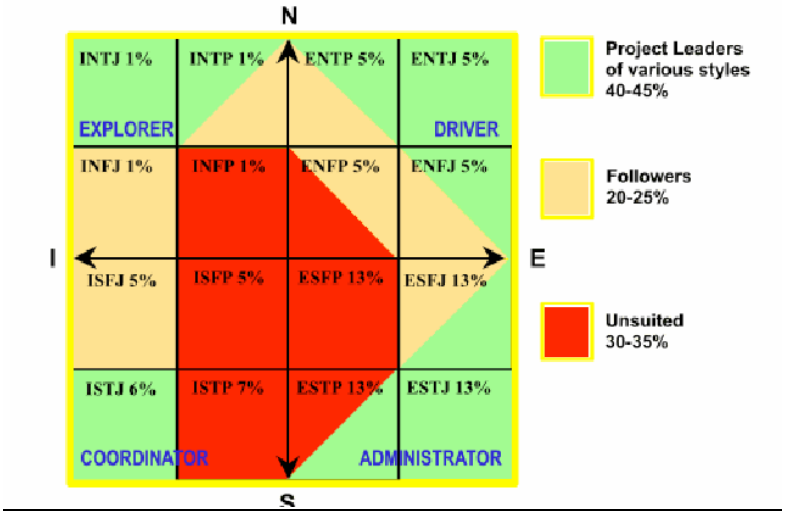


Source: www.visiontss.com

Project Human Resources Management

People will ultimately determine project performance and success. So knowing how to manage your human resources will be critically important. This starts with identifying the resources you will need – different roles and responsibilities, skills required, and how long will you need each person (don't forget project work is temporary). Once you understand what you need and how long, you can then acquire the resources to build your project team. Project Managers often refer back to their project schedules to determine human resource requirements. This involves looking at the work that must get done and the available budget for the project. The trick is to get your project team 100% allocated into the schedule, filling up the time and costs that are available. This is referred to as Resource Loading.

Project teams will also require some form of development, such as training, mentoring, and leadership to ensure project performance. Similar to any undertaking, there are a host of issues associated with managing project teams, such as resolving conflicts, communicating expectations, and keeping everyone on track and motivated. It's also useful to identify the types of people well-suited for project related work. One tool commonly used is the Myers-Briggs Type Indicator:



Source: Wideman, R. Max and Aaron J. Shenhar, "Professional and Personal Development: A Practical Approach to Education and Training," Project Management for Business Professionals, edited by Joan Knutson, 2001, p. 375.

One of the biggest challenges in any project is trying to match up the right people with the work, assigning roles and responsibilities, and getting everyone to work as a cohesive team.

> "When you are asked to lead a project, one of your main tasks will probably be to coordinate the efforts of a team. You will need to define who is fulfilling which role in your project, and who has a stake in the process and final outcome. A stakeholder is anyone who can affect, or is affected by, the process or outcome of the project."
> – Self-Development for Success – Project Management: The Essential Guide to Thinking and Working Smarter by Peter Hobbs

Project Communications Management

Projects involve teams, stakeholders, contractors and other groups. Each has its own communication needs. So a good starting point with project communications management is to determine the needs of everyone touched by the project. Once you understand everyone's needs, you can implement a communications plan, listing each group and identifying the communication mediums (email, formal reports, weekly meetings, etc.) and frequency (weekly, monthly, etc.). As a minimum, most projects will require a weekly status report and / or meeting since you need to monitor execution of the project schedule.

The Communications Plan can also include information about communication standards that will be followed, such as email protocol, use of agendas and minutes for meetings, and formats for reports. It's also a good idea to have a shared web-based location where all files, reports, and other documents are shared between the project team and the client. Keep in mind that projects generate lots of deliverables or documents and a common repository is needed to organize and track different iterations of your deliverables.

Communication Control Summary

Project Stakeholder	Communication Description	Medium Used	Source(s)	Distributed By	Desired Outcome
Client – Director	Status Updates	Written Reports	Weekly Project Meetings with Team	Project Manager	Customer OK on schedules, changes, approach, etc.
Client – Staff	Statue Updates	Written Reports	Weekly Project Meetings with Team	Project Manager	Staff concurs with approach, work load,
Project Director	Monthly budget and billing report	Email Spreadsheet	Project Team Timesheets	Project Manager	Project Director OK with margins
Project Manager	Team Meetings	Face to Face	Project Team, client feedback	Project Team	Account for all work and hours assigned
Project Team	Team Meetings	Face to Face	Client feedback, quality reviews	Project Manager	Team is on-track, motivated, focused
Sub Contractor	Integration of cross over work	Face to Face	Project Team feedback and schedules	Project Manager	Acceptable performance

Project Risk Management

Just like any other endeavor, projects have all types of risks:

- Work products and deliverables are not acceptable to the customer.
- New technologies make current solutions obsolete.
- Project specific risk, such as budget and schedule objectives are not achievable and most notably the possibility of scope creep (usually caused by new requirements).
- Business related risk, such as changes in leadership, competitive pressure, and financial difficulties unique to the organization that could impact the project.
- Operating risk, such as reliability of systems, difficulty with using support services, and administrative problems.
- Strategic risk, such as a project that has little or no strategic impact within the organization or a sudden change in corporate strategy that puts a project at risk in relation to the new strategic plan.

> "A risk is anything that may happen that could create an adverse effect to your schedule, costs, quality, or scope."
> – Project Planning, Scheduling, and Control: A Hands-On Guide to Bringing Projects in on Time and on Budget by James P. Lewis

So it's important to have a viable risk management process in place, such as the following:

1. **Identify** - Based on assessments (such as Strengths, Weaknesses, Opportunities, and Threats) and other techniques (such as brainstorming), identify your different risks (such as those described above). You also have to view risks across a broad spectrum. This often takes the form of:
    a. Known Risk – These are risks that you can clearly identify; things you are aware that are likely to occur. For example, you may have some staff turn-over during the life of the project. This is to be expected and it can impact your schedule.

b. Known Unknown Risk – These are risks that you think could happen, but you have no real idea as to what the impact might be. For example, you are aware that the scope of your project could change, but there is no way to define the extent of the scope change.
c. Unknown Unknown Risk – These are things that you never expected to happen, but the impossible sometimes takes place. For example, you never thought that the project would be impacted by financial difficulties of the organization, but the entire project has been thrown into a tail-spin because of a bankruptcy filing.

2. **Define** – Risk are typically defined two ways: Probability (how likely the risk event will occur) and Impact (effect on the project if the risk event does occur). You can also categorize and prioritize your different risk.

Risk Rating Matrix

Probability	Different Impacts				
	No Impact	**Minimal**	**Moderate**	**Major**	**Critical**
0-10%	Low	Low	Low	Medium	Medium
11-40%	Low	Low	Medium	Medium	High
41-60%	Low	Medium	Medium	Medium	High
61-90%	Medium	Medium	Medium	Medium	High
91-100%	Medium	High	High	High	High

3. **Quantify** - Assign a value to your risks so that your project budget can cover these possible costs. For example, you can estimate impacts and probabilities for all of your risks. The project budget should take into account the severity of your risks:

No.	Risk Event	Estimated Impact	Probability	Risk Amount
1	Funding has not been approved for next year	$ 150,000	35%	$ 52,500
2	Software Add-On in not compatible with existing system	$ 450,000	60%	$ 270,000
3	End users will not adapt to new processes	$ 70,000	40%	$ 28,000

4. **Plan** - Develop a risk response for each risk. Most risk responses take the following forms:

a. Avoid – Risk with high probabilities and high impacts should be avoided. You may have to change how you plan and execute the project to get around these risks.
b. Accept – Risk with low probabilities and low impacts are accepted without any change in planning.
c. Mitigate – Risk with high probabilities and low impacts are usually handled through some form of mitigation.
d. Transfer – Risk with low probabilities and high impacts are typically transferred, such as insuring the asset and thereby the risk is transferred from the company to the insurer.

You can also convert some risk into opportunities. For example, you might have an opportunity to redefine your scope to better manage the project or maybe you can restructure the roles and responsibilities within your project team.

5. **Manage** - Monitor and control risk as you execute your project. Follow your strategy described in your risk management plan. If a risk event occurs, it becomes an issue and you follow your plan and / or implement alternative actions to close the issue.

Risk Management Plan

No.	Risk Event	Timeframe	Rating	Response	Strategy
1	Funding has not been approved for next year	Calendar Year 2008	Low	Accept	Monitor progress of amendment
2	Software Add-On in not compatible with existing system	Life of investment	High	Avoid	Do not accept packages that fail to meet software and hardware requirements
3	End users will not adapt to new processes	Nov 2008 forward	Medium	Mitigate	Develop communications plan, training, web site,

Project Procurement Management

Projects will often require the use of outside vendors, suppliers, facilities and other resources. Therefore, it is necessary to secure external resources for the project and this will require a procurement process. Procurement will usually involve a sequential set of steps, such as developing a Request for Proposal (RFP) that describes the specific requirements for the prospective vendor. You now need to conduct a market survey and identify the potential vendors. Next, you will invite the vendors to submit proposals per the RFP. This move's you to the next procurement phase of selecting the right vendor.

You may need to develop a "short list" of the top vendors that have good proposals. Next, you will invite the vendors (on the short list) in for a formal presentation to make sure you understand their proposals. Once you have the necessary information, you award the contract to the winning proposal. This moves the procurement process into a contractual phase whereby you execute a contract with the awarded vendor (which we will now call a Contractor). The awarded work gets better defined through a document called the Statement of Work (SOW). And the SOW is structured in such a way that the contractor can create a work breakdown structure for executing the work.

There are several practices that need to be engrained into your procurement practices:

- Knowing what resources should and should not be outsourced through the procurement process.
- Following standard administrative procedures that are common to procurement, such as documentation and tracking of each step in the process.
- Develop clear and thorough requirements for your Request for Proposal – otherwise vendors will submit proposals that fail to meet your real needs.
- Set definite dates throughout the process, such as when proposals are due.
- Have a complete set of evaluation criteria to evaluate each proposal.

Once you have completed the procurement process, you will need to administer the contracts that are awarded to the winning vendors. This can involve things like monitoring the quality of deliverables, performance of the project schedule, and communicating changes to the project team. Outside vendors or contractors should

submit a Project Management Plan that integrates with the plan and schedule for the overall project within the organization.

Project Integration Management

The final area has to do with pulling it all together into some cohesive overall framework so that things are under control. If you expect to execute a project, then you need to integrate scheduling, budgeting, planning, communications, quality, and all of the components that make up project management. A centralized process is often desirable in making integration work. Also, there are several drivers behind good integration and most of these are fundamental to good project management:

- Clearly defined goals, objectives, targets, milestones, and other acceptance criteria to keep the entire project team highly focused on what needs to get done.
- Descriptions and communication regarding roles and responsibilities for all team members. Everyone needs to understand what they are responsible for and how it fits within the entire project.
- Regular meetings, discussions, and reviews of progress to date and any necessary changes to keep the project on track. Communication goes a long way in driving good integration.
- Documented references, links, matrix templates, and other tools for ensuring traceability and cohesion in project work.
- Addressing compatibility issues, such as software architecture and hardware issues. Larger organizations may have an Enterprise Architecture that helps define how systems need to work together.

The Triple Constraint

We touched on three project disciplines in this chapter: Project Scope Management, Project Time Management, and Project Cost Management. These three areas typically form what project managers dub the Triple Constraint. Just to recap, these three dimensions of project management involve:

1. Scope – The project work that must get done.
2. Time – When the work must get done.
3. Costs – How much it will cost to get the work done.

The challenge is to balance all three of these (scope, time and costs) and still be successful in how you manage the project. For example, suppose you expand the scope of the project, increasing the amount of work. This in turn requires more time and / or higher costs. Therefore, the three constraints are competing with one another, imposing a so-called triple constraint in project management.

Chapter

3

Nuts and Bolts Revisited

In the first two chapters of this short course, we touched on certain components used in project management – things like a Work Breakdown Structure and the Performance Measurement Baseline. Let's revisit these specific components and make sure we fully understand how all components are created and work together. This will include the following areas:

1st – Getting the project organized into control accounts through the creation of a Work Breakdown Structure and Organizational Breakdown Structure.

2nd – Creating a project schedule covering all of the required work.

3rd – Creating a time-phased budget for all of the work that has been scheduled.

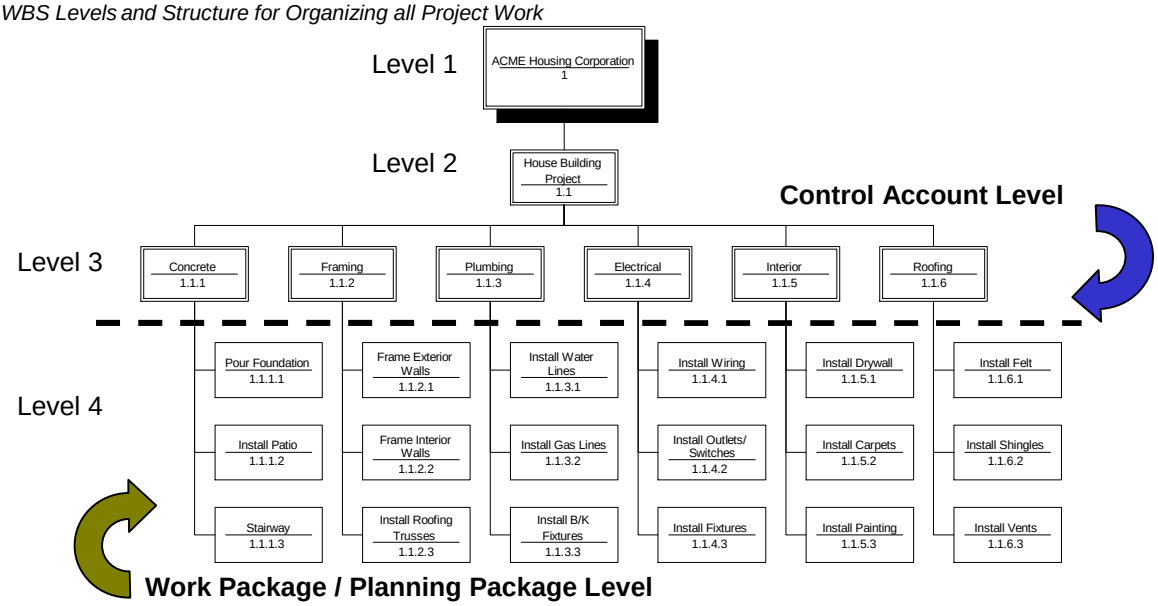
4th – Capturing the data that reflects project execution, such as hours worked and actual costs from contractors.

5th – Managing all of the changes that take place during the life cycle of the project.

Work Breakdown Structure

The scope of all work is described through the Work Breakdown Structure (WBS). The WBS facilitates planning and scheduling of project work. The WBS is usually organized in the form of a hierarchy with each level down providing more detail about the work.

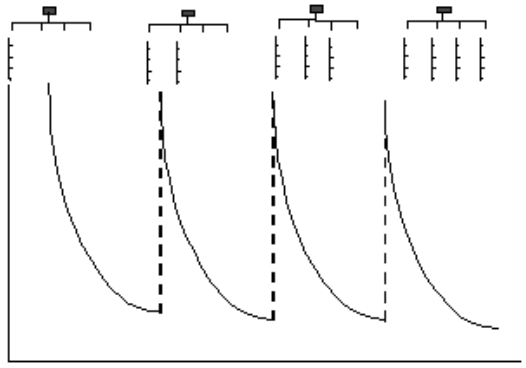
WBS Levels and Structure for Organizing all Project Work



Source: Booz Allen Hamilton (www.boozallen.com)

Additionally, your WBS will cover your entire project life cycle; however, the further out you go, the less detail you may have since the work is not clearly defined until most of the preceding work gets done. Therefore, you may end up following a "rolling wave" approach in how you manage the work and your respective WBS. A rolling wave lacks a detail WBS for work that is far-term and includes a detail schedule for work that is relatively short-term, such as the next six months.

Rolling Wave - WBS is constructed as you move through the life cycle



Source: www.pdma.org

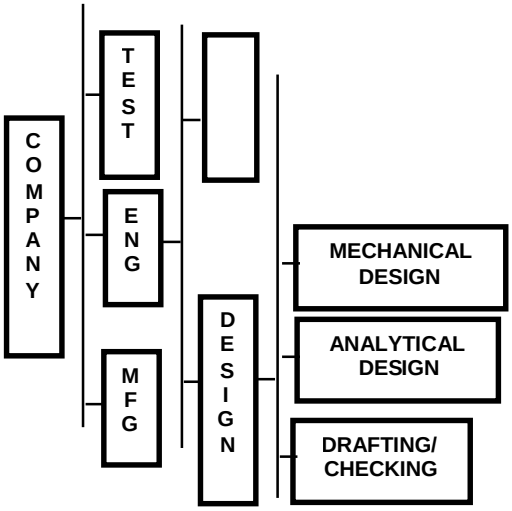
Finally, here are some rules to follow when developing your Work Breakdown Structure:

- All work should get addressed once within your WBS. This puts the right structure in place for executing the project.
- Each descending level of the WBS represents increased detail definition of the work.
- All work is assigned to one responsible individual.
- Where possible, the WBS should define a tangible work product or output so we can clearly measure progress.
- The WBS should be organized to show how the work will get done; i.e. you may want to show phases and sequences over time.
- Your WBS should get defined down to an appropriate level where you need control and accountability in measuring project performance.
- It's a good idea to summarize your major WBS elements in terms of a WBS Dictionary, describing the WBS element and its unique identification codes, listing Point of Contact information for who is responsible for the work associated with the WBS, planned start date, planned completion date, and planned costs.

> "The WBS depicts how the work of the project is subdivided into individual components. The WBS is more than just a list of tasks within the project. It is a hierarchical structure that depicts how the work is organized. It shows how the overall project is subdivided into lower-level components called control packages and how these control packages are finally subdivided into work packages. Work packages are the lowest level of decomposition of the work that the project manager manages."
>
> – Modern Project Management: Successfully Integrating Project Management Knowledge Areas and Processes by Norman R. Howes

Organizational Breakdown Structure

The WBS represents the “what” we will do; i.e. this is the work that must get done. The next question to ask is: Who will do the work. This requires assigning the work to various resources – people who either work for the organization or who are external to the organization, such as outside contractors. Since projects use a wide range of people related resources, it is useful to express all resources in the form of an Organizational Breakdown Structure or OBS. Similar to the WBS, the OBS represents a structure expressing the various organizational elements (both internal and external) assigned to the work (as defined by the WBS).



Control Accounts

Once you have defined the work in terms of a WBS and once you have assigned and organized the resources into an OBS, you are ready to establish control points in managing the project. These control points are found by looking at the intersection between your WBS and OBS. This is often expressed using the Responsibility Assignment Matrix (RAM) and the lowest level of intersection between the WBS and OBS is typically your control point.

Responsibility Assignment Matrix (RAM)

WBS activities →

OBS units ↓	1.1.1	1.1.2	1.1.3	1.1.4	1.1.5	1.1.6	1.1.7	1.1.8
Systems Engineering	R	R P					R	
Software Development			R P					
Hardware Development				R P				
Test Engineering	P							
Quality Assurance					R P			
Configuration Management						R P		
Integrated Logistics Support							P	
Training								R P

R = Responsible organizational unit
P = Performing organizational unit

Source: Information Technology Project Management by Kathy Schwalbe

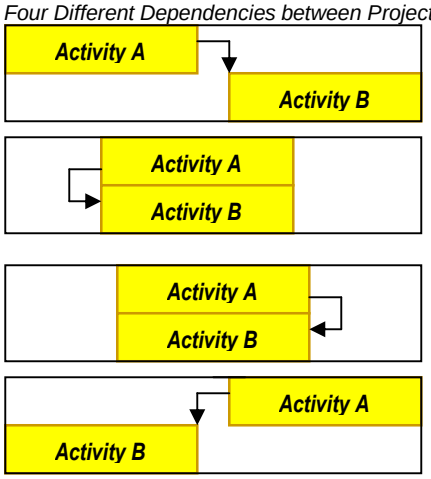
Project Scheduling

Now that we have defined project work in terms of the WBS and we have assigned and organized our resources as reflected with the OBS, we need to prepare a work schedule, showing start dates, completion dates and inter-dependencies between various tasks.

Here are the basic steps:

1. **Time Frame** - Start with establishing a start date and estimated completion date for the entire project. This super-imposes a time constraint on the schedule you are about to build.
2. **Listing** - Next, identify all of the activities (tasks) you need to accomplish. This may require a brain-storming session with the entire project team.
3. **Sequence** - Arrange the activities (tasks) in the order they will occur. This requires that you understand the relationships between all activities. For example, you may have an activity that cannot start until another activity gets completed. Likewise, you may have an activity that cannot finish since it depends on the outputs of another activity. Therefore, activities tend to have either predessor or successor activities; i.e. most activities have an activity preceding it (predessor) and an activity succeeding it (successor). Depending upon how the work gets done, you can have four variations in how any two activities relate to one another:

Four Different Dependencies between Project Activities



Finish to Start: Activity B cannot start until Activity A has been completed

Start to Start: Activity B cannot start until Activity A has started

Finish to Finish: Activity B cannot finish until Activity A has finished

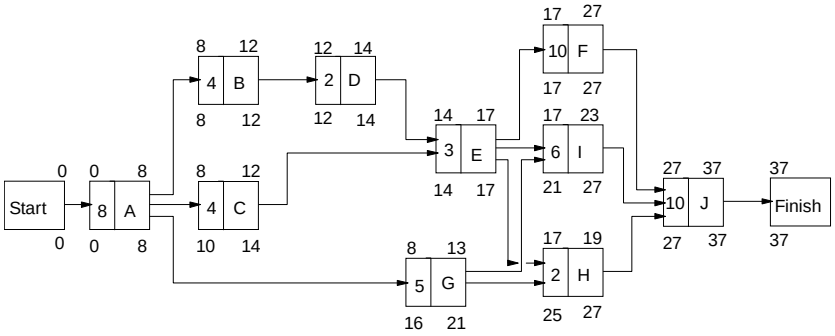
Start to Finish: Activity B cannot finish until Activity A has started

4. **Duration** – Assign a time frame for completing the activity. Don't forget to factor in some down time for contingencies and unexpected delays. Also, you may have an activity that has some slack time, waiting on other activities to finish or the activity can start over a range of different dates. Therefore, activities can have two possible start dates (earliest and latest) and two possible completion dates (earliest and latest). And based on this range of dates, you will have float times within your schedule.

   Durations are often estimated using PERT – Program Evaluation Review Technique. PERT calculates durations based on three estimates: Pessimistic (P), Most Likely (M) and Optimistic (O). The PERT formula is: (P + 4 M + O) / 6.

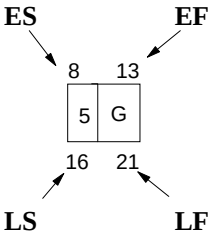
Example: Pessimistic estimate is 140 hours, most likely estimated time is 100 hours and an optimistic estimate is 30 hours. PERT Estimate is: 95 ((140 + (4 x 100) + 30) / 6

A visual model, known as a Network Diagram, is used to illustrate the project schedule:



Source: www.hmg.com.au

Referring to the above Network Diagram, this project has ten activities (A through J). Notice the sequence and flow from left to right. Activity A begins with Day 0 and takes 8 days to complete. Activity A has three successor activities: B, C, and G. Each activity box has four numbers outside the box denoting Earliest Start (ES), Earliest Finish (EF), Latest Start (LS), and Latest Finish (LF):



Earliest Start (ES): Earliest possible time the activity can start
Earliest Finish (EF): Earliest possible time the activity can finish
Latest Start (LS): Latest possible time the activity can start
Latest Finish (LF): Latest possible time the activity can finish
Duration = EF – ES or LF - LS

We can calculate float times for activities from our Network Diagram. The formula is: LF – ES – Duration. For example, Activity H has a float time of 8 days (27 – 17 – 2). The sequence of activities with the longest total duration is referred to as the Critical Path. Project Managers tend to focus on critical path activities since if these activities get delayed, then the whole project gets delayed. The Critical Path in the Network Diagram is Path 1 (A ► B ► D ► E ► F ► J):

Path	A	B	C	D	E	F	G	H	I	J	Duration
1	8	4		2	3	10				10	37
2	8	4		2	3				6	10	33
3	8	4		2	3			2		10	29
4	8		4		3	10				10	35
5	8		4		3				6	10	31
6	8		4		3			2		10	27
7	8						5		6	10	29
8	8						5	2		10	25

5. **Activity Talley** – Now total up the time involved to complete your activities. Does it fit within the project time frame (step 1)? If not, you have to revisit step 4 where you assigned durations.

6. **Resource the Activities** – Once everything fits within the time constraints defined in step 1, you can assign available resources to each activity and determine the costs.

When developing a schedule, you need to try to follow certain rules:

- **Activity vs. Steps** – Try to break your work down into several weeks. This constitutes an activity. Anything less than a few weeks, such as a few days, represent's a step attached to the activity. Likewise, if you have work that takes several months, then chances are you need to break it down further before you can declare that you have defined all of your activities.
- **Non-Work Time** - Factor in time that may be non-productive; i.e. people are not fully engaged and working continuously on the project, they take breaks, lose concentration, are pulled away temporarily to do something else, and take leave time (sick, vacation, and holidays). A general rule of thumb is 20% of time assigned to work will be non-productive.
- **Orphan Activities** – All activities should have at least one predessor activity and successor activity. Only the initial activity will not have a predessor activity and only the final activity will not have a successor activity.
- **Concurrent Activities** – In order to fully use your resources, you probably will need concurrently activities, but these activities need to fit within a bigger and fully integrated schedule so that you do not have orphan activities. Going back to our Network Diagram, we had Activity B and C starting on Day 8, but eventually everything ends up at one final activity J.

Developing the Project Budget

All of the project work is now organized and scheduled. So the next question to ask is: How much will all of this work cost? This requires that we develop a project budget from the bottom-up; i.e. at the lowest level of work such as activities. As we move out into later years, our estimates are not as accurate. For example, work that is planned three years from now is not well defined in terms of activities. This may require a "Rough Order of Magnitude" type estimate. Regardless, we need to develop a budget that will fund the entire life cycle of the project.

Accuracy in Cost Estimates will Vary

Type of Estimate	When Done	Why Done	How Accurate
Rough Order of Magnitude (ROM)	Very early in the project life cycle, often 3–5 years before project completion	Provides estimate of cost for selection decisions	–25% to +75%
Budgetary	Early, 1–2 years out	Puts dollars in the budget plans	–10% to +25%
Definitive	Later in the project, less than 1 year out	Provides details for purchases, estimates actual costs	–5% to +10%

Source: Information Technology Project Management by Kathy Schwalbe

Let's start with a framework for estimating costs – Work Breakdown Structure. You need a reliable WBS for a reliable cost estimate since you have to cover all of the costs associated with all of the work (WBS). Additionally, for each WBS element, you should account for at least four cost elements:

1. Labor – All people assigned to the project will charge their time to the project. Direct labor costs can include both in-house personnel and contractors. You need to account for all labor expected to work on the project. You should also account for any fringe benefits that the organization pays on top of the base labor costs.
2. Materials – Projects may require equipment, furniture, and other hard assets. You need to estimate your materials costs as part of your budget.
3. Other Direct Costs – Projects may involve some travel expenses or other direct costs directly associated with the project.
4. Indirect Costs – Projects receive benefits from support services and facilities. For example, an organization's HR (Human Resource) Department may provide some assistance for recruiting and processing personnel assigned to the project, but these costs are not charged directly to the project. So there is a need to recognize costs associated with these indirect benefits received by the project.

Once you have completed your cost estimate, you need to make sure you have included risk adjustments since you will experience some unplanned events. Project Managers typically account for three risks in their budgets:

1. Known Risks – Project Managers are fully aware of these risks and they include them directly into their budget formulations. Some Project Managers have rules of thumb they follow to measure known risks, such as the following:

Activity	Rule Of Thumb
Project Management	A full time Control Account Manager is required for every six staff assigned to the project.
Business Analysis	Allow a figure of 20% of the time allowed for the technical tasks to complete the business specification.
Systems Analysis and Design	Allow a figure of 25% of the time allowed for the technical tasks to complete the design specification.
Peer Testing	Allow a figure of 10% of the time allowed for the technical tasks.
Integration Testing	Allow a figure of 15% of the time allowed for the technical tasks.
Acceptance Testing	Allow a figure of 15% of the time allowed for the technical tasks.
Deployment	Allow a figure of 5% of the time allowed for the technical tasks.

Source: www.projects.ed.ac.uk

2. Unknown Risks – Project Managers are aware that certain unknown events do take place, usually involving new requirements and scope changes to the project. Project Managers typically include a contingency amount for certain changes that they believe could occur.

3. Unknown Unknown's – Project Managers usually add a risk reserve amount into their budgets, such as 10% of the total project costs to cover things that they cannot possibly plan for.

If we take a "bottom-up" approach to cost estimation, we would start at the lowest level – activities and roll-up everything to higher level WBS elements.

Bottom-up Cost Estimate at the WBS Level

Cost Estimate – Risk Analysis Work (WBS 3.2)			
Labor Category	Hours	Rate	Total
Engineering Analyst II	100	$ 42.35	$ 4,235.00
Engineering Analyst III	50	$ 47.50	$ 2,375.00
Application Programmer II	10	$ 38.35	$ 383.50
Application Programmer III	5	$ 41.75	$ 208.75
Quality Assurance Analyst	40	$ 42.65	$ 1,706.00
Software Engineer II	35	$ 44.85	$ 1,569.75
Technical Writer	25	$ 36.80	$ 920.00
Project Manager	65	$ 56.90	$ 3,698.50
Total Direct Labor Costs			$15,096.50
Add Fringe Benefits @ 30%			$ 4,528.95
Total Labor Costs			$ 19,625.45
Contract Services – XYZ (firm fixed priced)			$ 6,500.00
Contract Services – ABC (firm fixed priced)			$ 4,600.00
Computer Equipment and Accessories			$ 7,600.00
Indirect Costs @ 12% of Total Labor Costs			$ 4,528.95
Total Estimated Costs			$ 42,854.40
Project Specific Risks (Rework, Migration, etc.)			$ 6,200.00
Contingencies and Mitigation			$ 4,150.00
Risk Reserve @ 10% of Total Estimated Costs			$ 4,285.44
WBS 3.2 PROPOSED BUDGET (rounded up)			$ 57,500.00

Performance Measurement Baseline

The major components for project execution should now be in place – WBS, OBS, Control Accounts, Schedule, and Budget. Our final step is to integrate all of this information into a Performance Measurement Baseline. The Performance Measurement Baseline (PMB) is the benchmark by which you evaluate project performance. A PMB represents the culmination of all your planning efforts – getting your WBS right, scheduling the work, assigning budgets and resources, and knowing that you are ready to measure your performance going forward. Therefore, the PMB is a snapshot at a certain point of time that finalizes the planning process for a project.

Where practical, you should try to manage your PMB around the following business rules:

1. Changes to the PMB require approval outside the project team.
2. Changes to the PMB are cascaded down to the lowest levels of the project plan for complete integration of the change.
3. Changes to the PMB are pre-planned according to an annual calendar, such as annual revisions to budgets within the organization.
4. Changes to the PMB consider scope, schedule and the budget since all three of these are related.
5. Changes to the PMB are properly documented in terms of the effective date of the change, who requested the change, who approved the change, and where the change was made.

If you reach a point where you can no longer manage to your PMB, then it may be necessary to update and change your current baseline. However, changes to the PMB should be rare since you want to avoid things like scope creep. However, unplanned events do happen and they could require a revised PMB.

Change to PMB is Appropriate	Change to PMB is Not Appropriate
Changes directed by Senior Management, such as sudden budget cuts.	Poor project planning, including bad cost estimates
Delays in Funding, Contracts or Critical Events that have already been included in the PMB	Delays created by the project, including late or inadequate deliverables
Actions beyond the control of the Project Team, such as new requirements imposed from outside the project	Failure to analyze and correct past project performance

Besides schedule (time) and budget (costs), one of the more visible components to your PMB are the measurable events that take place. So it is important to express your progress in tangible terms – the specific work products or milestones that indicate project success; such as the following:

Life Cycle Phase	Output / Work Products
Project Justification	Concept Paper, Business Case
Project Initiation	Project Management Plan, Risk Management Plan, Concept of Operations
Analysis	System Requirements, Gap Analysis
Design	Software Design Documents, Test Plan
Development	Acceptance Testing Completed

The planning process is now complete – you have a "locked down" schedule to measure your project against, the Performance Measurement Baseline. Just to recap the steps:

1. WBS / OBS / Control Accounts: We developed a structure for managing the project work.
2. Sequence the Work: We organized the work in the order in which it takes place.
3. Prepare a Schedule: We expressed our schedule in terms of a Network Diagram.
4. Resources: We assigned resources to the work.
5. Budget: We develop a risk adjusted budget to fund the project.
6. Performance Measurement Baseline: We integrated everything together to finalize our project plan.

Change Control Process

Projects are very dynamic – new requirements are discovered leading to changes to project scope, deliverables fail to meet quality standards, funding for the project gets cut, staff turnover, and other changes will necessitate a way of controlling all of these dynamics. Change control is one of the biggest challenges confronting a project since change often increases the risk, costs, and duration of the project. A centralized control process will be needed to manage changes to scope, schedule and budgets. Depending upon how significant the change is, there will be different levels of authority for approving the change.

In addition to internal project changes (scope, schedule and budget), projects usually are confronted with external change. External changes are much more difficult to control since the Project Team has little control over the process. Regardless, you will need to address both internal and external changes:

1. Recognize different changes that require control.
2. Establish control forms, communication channels, and other controls to capture and review the change.
3. Determine the impact of the change and communicate the change to those affected.
4. Where appropriate, have approvals and documentation procedures for managing the change.
5. Process and integrate the change into the project, such as changes to the Performance Measurement Baseline.
6. Verify that the change was in fact processed.

Projects often attempt to centralize the change control process by using a Change Control Log to document the date of the change, who originated the change, status (approved, open, canceled, etc.), amount of the change if applicable, highest WBS levels impacted, type of change and other important elements. In the case of technology related projects, this may take the form of Configuration Management. Configuration Management is a process for managing all of the components and work products that go into building a system. This includes the life cycle of managing the system, from determining the requirements to maintaining the system. Additionally, most systems tend to "evolve" over time and you need a formal model to manage these changes, such as:

1. Submit – Changes are submitted and processed through a standard form or screen.
2. Evaluate – Analyze the change and work back upstream in the life cycle to determine how requirements must change. Decide how the change should be handled.
3. Approve – Authority for changes decisions often follow threshold impacts and the ultimate authority for a change usually resides with the customer.
4. Implement – Develop a plan to implement the change, test the change, and report the successful implementation of the change.
5. Test – Run tests to make sure the change worked as expected and no new changes pop-up as a result of this change.
6. Update – Once you know the change is correct, you need to update your production related elements. This might include technical and user training documents. It might also involve software applications. Version control numbers are used for hard documents and release control numbers are used for software programs.

Projects will also impose enter and exit criteria during the project life cycle. These toll-gates keep things on track and put discipline behind overall project management. For example, before a project can exit the Initiation Phase of the life cycle, you may require that the project have an approved Business Case. Likewise, a project can not start the Planning Phase until it has an approved Project Charter.

Chapter
4

Earned Value Management

One of the more popular approaches to measuring project performance is something called Earned Value Management (EVM). Earned Value Management is a methodology for comparing the progress of work in relation to your Performance Measurement Baseline. EVM measures project performance in terms of the budget and the schedule. However, unlike traditional approaches to budgeting which compares the budget to actual costs, EVM will use three performance parameters to measure project performance:

1. Planned Value (PV) – This is the budget, broken out over the life cycle of the project.
2. Earned Value (EV) – This is the planned or budget value that you have earned at different points in time, measured by looking at how much work has been completed.
3. Actual Costs (AC) – This is the actual costs incurred to date for the work.

All three of these performance parameters (PV, EV, and AC) are captured at the lowest control levels, namely control accounts (which we discussed in the previous chapter). And as we indicated earlier, it is important to create a Performance Measurement Baseline (PMB). This is the backbone for making EVM work; i.e. EVM is only as good as your PMB.

Using the three performance parameters (PV, EV and AC), we will calculate two variances for expressing project performance:

1. Cost Variance (CV) = Earned Value (EV) – Actual Costs (AC)
2. Schedule Variance (SV) = Earned Value (EV) – Planned Value (PV)

We can also express this information in the form of an index:

3. Cost Performance Index (CPI) = EV / AC
4. Schedule Performance Index (SPI) = EV / PV

An index makes it easy to read the performance results; i.e. if you are above 1.0, then this is favorable performance and if you are below 1.0, this is unfavorable performance.

Index	Cost (CPI)	Schedule (SPI)
>1.00	Under cost	Ahead of schedule
=1.00	On cost	On schedule
<1.00	Over cost	Behind schedule

EVM Example

Let's assume we have a project requiring ten major work products:

1. User Requirements
2. Business Case
3. Risk Management Plan
4. Concept of Operations
5. System Requirements Specification
6. Alternative and Gap Analysis
7. Software Requirements
8. Software Specifications
9. Preliminary Design Document
10. Test Plan

You are given a total budget of $ 320,000 to complete all of the work over the next 12 months. You have created a Work Breakdown Structure for the work and assigned all work to internal and external resources. You then prepared a detail project schedule for the next 12 months. Using Control Accounts, you developed a budget from the bottom-up, taking into account various risks and contingencies that could occur. This is summarized in the following baseline:

Table A: 12-Month Time Phased Budget or Planned Value

WBS / Deliverable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Totals**
2.1 – User Requirements	10	15	35										60
2.2 – Business Case		5	20	5									30
2.3 – Risk Management Plan			3	14	3								20
2.4 – Concept of Operations					25	30	5						60
3.1 – System Requirements Spec							15	10					25
3.2 – Alternative Analysis								10	3				13
3.3 – Software Requirements									20	10			30
3.4 – Software Specifications									4	22			26
3.5 – Preliminary Design										6	30	6	42
3.6 – Test Plan											6	8	14
Monthly Budget or Planned Value (PV)	10	20	58	19	28	30	20	20	27	38	36	14	**320**
Cumulative Budget or Planned Value (PV)	10	30	88	107	135	165	185	205	232	270	306	**320**	

Now let's move forward to May and evaluate our performance using Earned Value Management. According to our baseline (Table A), we have Planned Value of $ 135,000 as of May 31st. We need to calculate Earned Value (EV) and sum our Actual Costs (AC) for all control accounts as of May 31st. In order to calculate EV, we will need to evaluate how much of the work is complete as of May 31st. Tangible work is typically measured three ways:

1. Fixed Formulas – Expressing the work as complete using a set formula. This is usually done when the work can be finished within one or two reporting periods (monthly). Examples would include:
    a. 50 / 50: Implies that 50% of the work is complete for the initial reporting period and the remaining 50% is complete when the work is actually finished. For example, total planned value for the work product 2.2 Business Case is $ 30,000. If we use the 50 / 50 formula, then we would report $ 15,000 of Earned Value in our first monthly report and we would report the remaining $ 15,000 of Earned Value when we have delivered the final Business Case document.
    b. 25 / 75: Implies that 25% of the work is complete for the initial reporting period and the remaining 75% will get reported as Earned Value when the work is completed.
    c. 0 / 100: Implies that we will recognize all of our Earned Value when we have finished the work.

2. Weighted Milestone – Assigning weights to the value of the work, such as the outcomes achieved in relation to the total planned value for the work. For example, the Concept of Operations deliverable (WBS 2.4) requires a section describing the as is process and documenting the future process. Trying to document the future work flows and system architecture is more difficult than trying to illustrate current work flows and architecture. So we have broken down the work into distinct activities at Level 4 in our WBS and have assigned the following weights:

Table B: Calculate Earned Value for WBS 2.4: Concept of Operations

Work Activity / Major Steps	Weighted %	Earned Value	Complete? Yes or No
2.4.1.1 – Document As Is Work Flow	15%	9,000	Yes
2.4.1.2 – Document As Is Architecture	20%	12,000	Yes
2.4.1.3 – Document To Be Work Flow	28%	16,800	No
2.4.1.4 – Document To Be Architecture	37%	22,200	No
Total	100%	60,000	

This would give us an accumulated Earned Value amount of $ 21,000 ($ 9,000 + $ 12,000) as of May 31st.

3. Percent Complete – Applying a percentage to the total planned value of the work in relation to what you believe has been completed. This is a relatively straight forward and simple approach to calculating your Earned Value. For example, we have estimated that our Risk Management Plan (WBS 2.3) is approximately 85% complete, giving us an Earned Value of $ 17,000 ($20,000 x .85) as of May 31st.

The following table summarizes the Earned Value we will report as of May 31st:

Table C: Earned Value Calculations as of May 31st

Work Product / Milestone	EV Method Applied	EV Calculation	Earned Value
2.1 – User Requirements	% Complete	100%	$ 60,000
2.2 – Business Case	Fixed Formula	50 / 50	$ 15,000
2.3 – Risk Management Plan	% Complete	85%	$ 17,000
2.4 – Concept of Operations	Weighted Milestone	See Table B	$ 21,000
Total Earned Value			**$ 113,000**

OK, we have two of our three performance parameters (Planned Value and Earned Value). The last parameter is to capture actual costs (AC) for all control accounts that comprise our Performance Measurement Baseline:

Table D: Summarize Actual Costs (AC) by WBS as of May 31st

Level 3 WBS	1	2	3	4	5	6	7	8	9	10	11	12	Totals
2.1.1	6												6
2.1.2	5	1											6
2.1.3	3	7	2										12
2.2.1	1	11	4										16
2.2.2		2	14	10									26
2.3.1			13	7									20
2.3.2			22	11									33
2.3.3				2	8								10
2.4.1				1	12								13
2.4.2					7								7
2.4.3					2								2
2.4.4					3								3
Monthly Actual Costs (AC)	15	21	55	31	32								**154**
Cumulative Costs to Date	15	36	91	122	**154**								

We can summarize our three performance parameters as of May 31st as follows:

Table E: EVM Performance Parameters as of May 31st

Work Product / Milestone	Planned Value (Table A)	Earned Value (Table C)	Actual Costs (Table D)
2.1 – User Requirements	$ 60,000	$ 60,000	$ 24,000
2.2 – Business Case	$ 30,000	$ 15,000	$ 42,000
2.3 – Risk Management Plan	$ 20,000	$ 17,000	$ 63,000
2.4 – Concept of Operations	$ 25,000	$ 21,000	$ 25,000
Total Reported Values	**$ 135,000**	**$ 113,000**	**$ 154,000**

Now calculate the EVM performance measures:

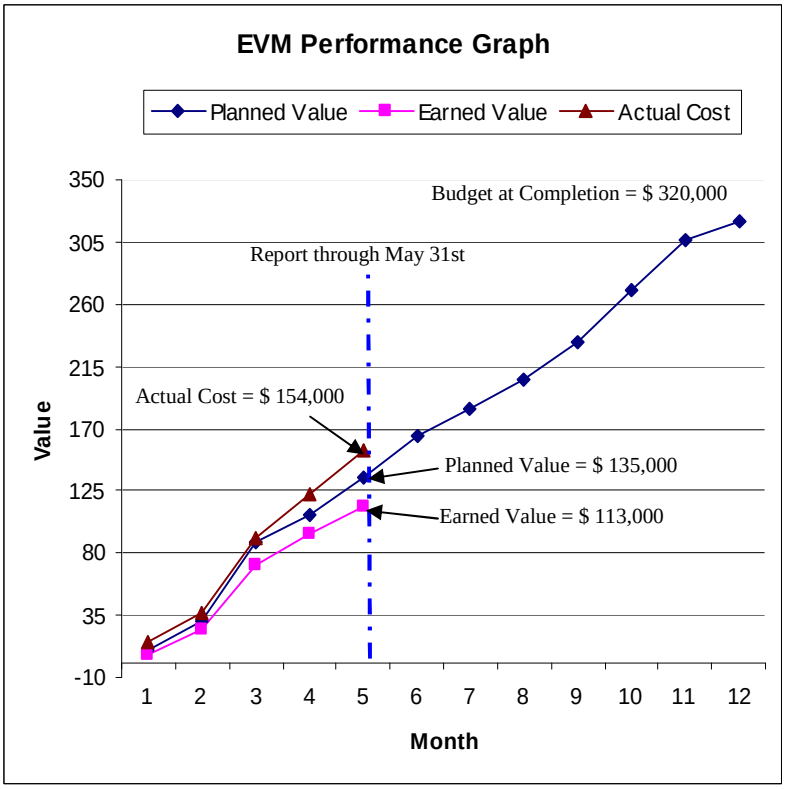
1. ***Cost Variance (CV) = $ 113,000 - $ 154,000 = $ -41,000***
2. ***Schedule Variance (SV) = $ 113,000 - $ 135,000 = $ -22,000***
3. ***Cost Performance Index (CPI) = $ 113,000 / $ 154,000 = .73***
4. ***Schedule Performance Index (SPI) = $ 113,000 / $ 135,000 = .84***

The EVM measures indicate:

1. ***We are over-budget by $ 41,000***
2. ***We are behind schedule by $ 22,000***
3. ***For every $ 1.00 spent, we have completed $ .73 worth of work***
4. ***For every 1 hour of work scheduled, we have completed 50 minutes of work (60 minutes to an hour x .84).***

We can summarize and trend our EVM performance on a graph:

Reporting Cumulative EVM Performance on a Graph



Each month, we will update this graph and report our project performance using Earned Value Management. We also need to forecast our final expected performance. This is accomplished by coming up with an Estimate at Completion (EAC); i.e. what will be our final total costs to complete this project? This is derived by looking back at past historical costs. This gives us an estimate of what it will take to complete the project going forward, referred to as the Estimate to Complete (ETC). Therefore, the EAC is simply all past historical costs incurred to date + ETC.

Let's assume that we examined our past historical costs of $ 154,000, looking at individual burn rates (how much time it takes to complete the work) and other specific cost trends that make up our total of $ 154,000. We have determined that we will need $ 255,000 to finish all remaining work.

EAC = Accumulated Actual Costs to Date + Estimate to Complete (ETC)
EAC = $ 409,000 or ($ 154,000 + $ 255,000)

When project performance is poor, it is a good idea to use the EVM indexes (CPI and/or SPI) as a performance factor in calculating your ETC and EAC. For example, we can test our ETC number where BAC is the Budget at Completion of $ 320,000:

ETC = (BAC – EV) / CPI
ETC = $ 283,562 or (320,000 – 113,000) / .73

We can also use the CPI to calculate our EAC as follows:

EAC = BAC / CPI
EAC = $ 438,356 or ($ 320,000 / .73)

Once we are comfortable with our ETC and EAC estimates, we will calculate a Variance at Completion. It's usually best to error on the side of a conservative estimate, so we will use the highest EAC in computing our variance:

Variance at Completion (VAC) = Budget at Completion – EAC
$ (118,356) or $ 320,000 - $ 438,356

This helps alert us early-on that we may need approximately $ 118,356 more in funding to complete the project based on the current baseline.

> "The estimate at completion (EAC) is an important measurement tool that is useful to track all aspects of a project: technical achievement, time, and cost. Most reports are concerned with the differences due to comparisons of actual measurement against the forecast, that is, the variance. This is also valuable information, but the real concern of any project is with the future, not altogether with what is happening now or with what happened recently, but what will we end up with, what will it look like when it's delivered, and when will it be done?"
> – The Art of Managing Technical Projects by Melvin Silverman

Earned Value Management System (EVMS)

Many organizations have taken EVM to the next level by implementing an Earned Value Management System or EVMS. In actuality, it makes sense to start with the standards associated with an EVMS and this enables you to do "real" EVM. This is due to the fact that an EVMS is a complete set practices that need to be in place in order for you to do EVM. And most of these practices have more to do with project management than the EVM metrics. For example, an EVMS requires that you have a WBS, OBS, and Control Accounts. This is important for creating a Performance Measurement Baseline which is the foundation for doing EVM.

EVMS requirements have been summarized by the National Defense Industrial Association (NDIA) in their publication: NDIA ANSI/EIA Standard 748 Intent Guide. So if you want to do EVM the right way, then you need to embark on implementing an EVMS and if you want to make sure you are meeting the requirements behind an EVMS, then start with the 32 Intent Guidelines published by the NDIA. (http://management.energy.gov/policy_guidance/earned_value_management.htm)

Some Problems with EVM

One of the dilemmas with Earned Value Management has to do with the time and effort involved in coming up with the performance parameters. For example, Planned Value is basically an estimate of where you think you will be in burning the budget and Earned Value is an estimate as to how much work you think you have completed in relation to the budget. This can be a very subjective exercise, taking considerable time and effort to determine values which are inherently unreliable over time. It might be better to deploy a simpler and faster approach. For example, control over a schedule has much more to do with control over the hours worked as opposed to the dollars involved; i.e. you have little or no leverage over the rates you pay people. All of the leverage resides in the hours. So it might be easier to focus on hours and not dollars (Earned Value).

Another problem with EVM has to do with the adage: What gets measured gets managed. In the world of EVM, we are measuring two things: Costs (EV – AC) and Schedule (EV – PV). However, projects are not about executing a budget or a schedule. Projects are ultimately about improving how things work within an organization – higher employee productivity, more efficiency in our processes, improved customer service, and so forth. Author Gary R. Heerkens does a good job of pointing this out in his book: The Business-Savvy Project Manager:

The Measures of Project Success are Changing

Today's Measures of Success	Future Measures of Success
Satisfy the triple constraint (cost, schedule, scope)	Satisfy a strategically aligned business need
Must not exceed the original project budget / Must not violate the original project deadline	Maximize the return on the money invested in the project
Meet the technical or functional specifications	Satisfy the "true needs" or root cause of the problem
Satisfy the needs of customers and users	Make customers and users want to keep coming back
Manage to a successful customer sign-off	Manage the overall project life cycle, including post-project.

Source: The Business-Savvy Project Manager by Gary R. Heerkens

> "The more business value that is achieved, the more successful your project will be. This means that even though a project is not on time and / or on budget, it can still be successful if project business value is achieved. Conversely, a project may be delivered on time and on budget and still be considered successful if no business value is achieved. In the latter case, however, project success is minimized because companies that deliver projects without providing business value will ultimately lose profits, lack business growth, and lose to the competition. It is the company that best utilizes precious time, money, and resources to achieve project objectives that will win in the end. As such, project business value becomes the key differentiator for delivering project success."
> – Maximizing Project Value by Jeff Berman

A More Balanced View of Project Performance

Project Performance Scorecard						
Low	1	2	3	4	5	High
Stakeholder / Client Groups are satisfied with Project Results						
Low	1	2	3	4	5	High
Project is meeting overall objectives and requirements						
Low	1	2	3	4	5	High
Project is meeting the budget						
Low	1	2	3	4	5	High
Project work products are delivered on time						
Low	1	2	3	4	5	High
Project will add value to the organization						
Low	1	2	3	4	5	High
Project is meeting quality standards						
Low	1	2	3	4	5	High
Satisfaction Rating with Project Team Members						

Source: www.ctg.com

Chapter

5

Some Advanced Topics

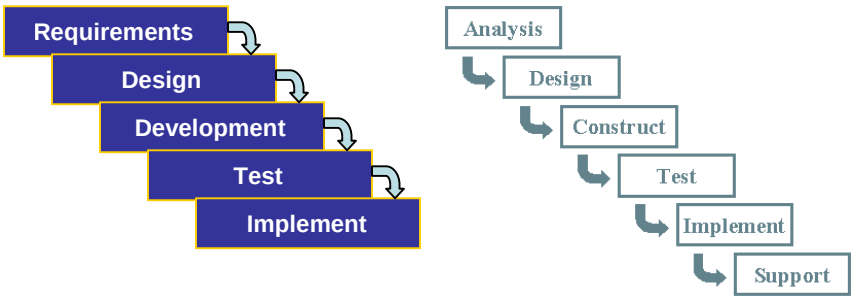
By now, you should have a good understanding of how project management works. This final chapter will touch on some miscellaneous topics, such as how the life cycle works on Information Technology (IT) type projects and why we might want to establish a Program Management Office (PMO).

System Development Life Cycle (SDLC)

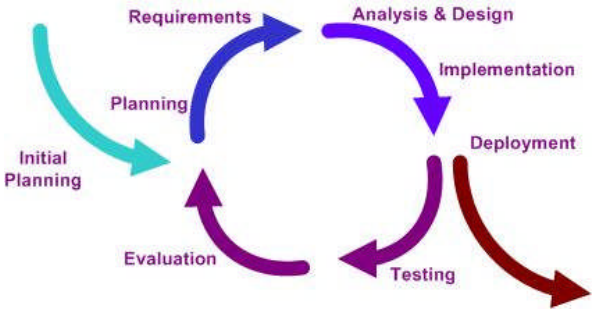
Many projects will involve technology or changes to existing systems. Many of these projects will follow a System Development Life Cycle. This cycle typically consists of several distinct phases:

Phase 1 – Requirements: Gather requirements from users, analyze the results and evaluate different alternatives to best address your requirements. Work products from this phase can include System Requirements Specification, an Analysis of Alternatives and Software Requirements Specification.
Phase 2 – Design: Once you understand the requirements, now design a possible solution and run some preliminary tests to see if your solution might work. Work products from this phase might include a Software Configuration Management Plan, Software Development Plan, Software Test Plan, and Preliminary Design.
Phase 3 – Development: Once we have a good final design, it's time to build the final solution. Work products include the "as built" documents for the new system, such as the Software Description, the Database Description and User Manuals.
Phase 4 – Testing: Before we put our solution into production, we need formal testing to make sure everything works. This might take the form of Independent Verification (make sure the solution meets specifications) and Validation (make sure the solution meets the needs of end-users). Work products for this phase are related to test results.
Phase 5 – Implement: Finally, we can deploy the solution to the target audience. Some of the work products for this phase are User Training, Implementation Plan, and Software Maintenance Plan.

Additionally, these phases may get managed in such a way that you try to complete one phase before moving on to the next phase. This approach is characterized as a "waterfall" approach:

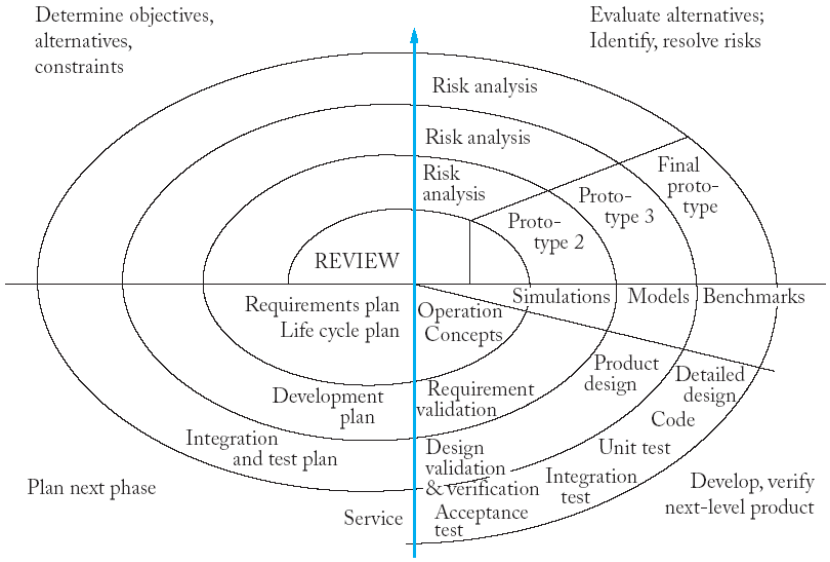


Another life cycle approach to SDLC is to recognize that you have to visit your requirements phase as you work through the entire SDLC and thus, it's best to work through iterations:



Source: http://en.wikipedia.org

If you follow small iterations over and over, you can better address your requirements, especially if requirements are unknown. Contrast this with the waterfall approach which is more restrictive - each phase is partitioned off from subsequent phases in the life cycle. Therefore, you tend to cut-off the learning process that invariably takes place in developing a system. A more iterative approach is sometimes characterized as a "spiral" approach to managing the SDLC:



Source: www.cs.waikato.ac.nz

If you are Google or some organization that has a high tolerance for learning and working through a process for innovative results, then a spiral approach probably makes sense. However, many organizations build on what they already have, such as installing a new module to their Enterprise Resource Planning system, not to mention that most organizations have limited resources. Therefore, a waterfall approach is often the favored approach where there is a clear goal and mission behind the project. One of the biggest reasons for following the waterfall approach has to do with costs. The further downstream in the life cycle a mistake is discovered, the more it cost to correct:

When Defect Is Detected	Typical Costs of Correction
User Requirements	$100 – $1,000
Coding/Unit Testing	$1,000 or more
System Testing	$7,000 – $8,000
Acceptance Testing	$1,000 – $100,000
After Implementation	Up to millions of dollars

Source: Software Testing and Quality Assurance by Ross Collard

So there is a major balancing act that takes place with many projects – trying to pass through a distinct phase for conserving resources (such as the waterfall approach) vs. trying to accommodate change and get it right despite availability of resources (such as the spiral approach). In reality, most projects tend to follow a hybrid that is in between these two approaches.

Finally, project teams will sometimes use CASE (Computer Aided Software Engineering) Tools to help automate various steps within the SDLC. Keep in mind that the SDLC has numerous work products (as described above for each of the five phases) and the outputs from one phase tend to represent the inputs into the next phase.

> "A traditional project looks like a waterfall, representing neatly cascading, sequentially flowing Gantt charts with eight levels of detail. Waterfall project management works well under conditions of relatively low speed and low uncertainty. It is well suited for traditional construction and engineering projects and others that have well-defined, concrete goals and a proven path to get there."
> – Extreme Project Management: Using Leadership, Principles and Tools to Deliver Value in the Face of Volatility by Doug DeCarlo

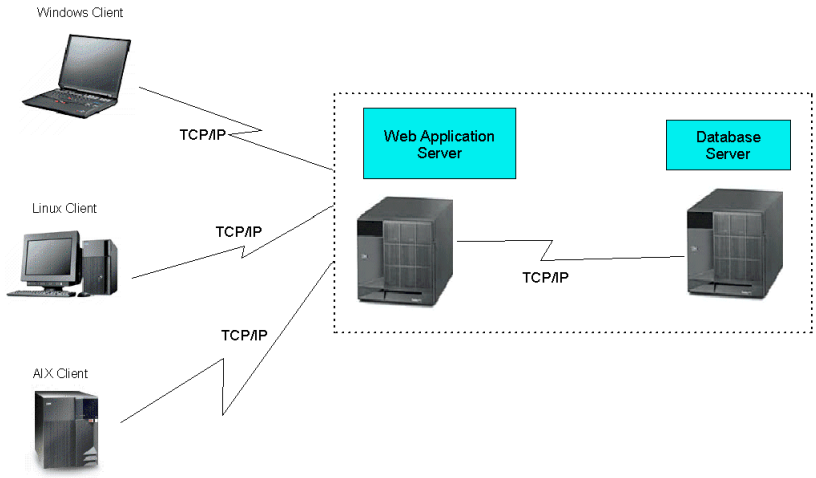
Requirements Analysis

In our previous discussion about SDLC, we noted that Requirements is the first major phase. Getting the requirements right is critical since everything downstream in the life cycle depends upon what you do during the Requirements Phase. Since requirements are critically important to managing the SDLC, we need to gain a better understanding of how to do requirements analysis.

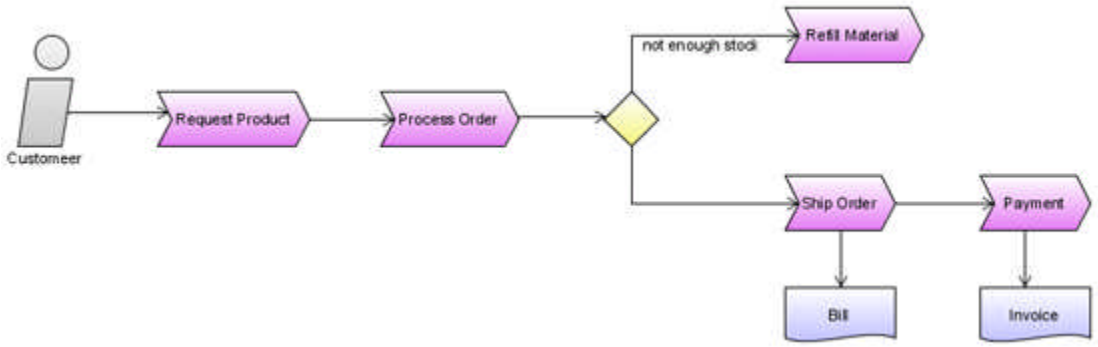
Similar to how we manage the entire project, requirements begins with the Concept of Operations or ConOps. The purpose behind a ConOps is to establish the scope for all requirements efforts. This includes an understanding of four important dimensions:

1. Current Architecture – What is the current system architecture and how do people interact with this current system?
2. Current Work Flow – What is the current work flow in relation to the current system architecture?
3. Future Architecture – What will the "to be" system architecture look like after the project fulfills its mission?
4. Future Work Flow – What will the "to be" work flow look like in relation to the future system architecture?

Example of a System Architecture Diagram



Example of a Work Flow Diagram



Your Concept of Operations should also take into account any future planned development projects already under-way. For example, you do not want to write requirements for issues that other projects are expected to address in the future. So the ConOps establishes a scope in terms of those things you need to address in relation to everything else that is currently planned throughout the entire organization. Once you define your scope through the ConOps, you can begin analyzing functional requirements with existing processes. This usually involves interviews with functional end-users and a review of desk or operating procedures. One of the goals is to determine various business rules that govern a process. Another important goal is to eventually write requirements that you can Design, Code, and Test to – the so called DCT Rule that

many try to follow. This usually requires that you go through a few levels in developing your requirements:

Level 1 Requirements – Functional Requirements: Non technical requirements that are descriptive of what users want the system to do. These sometimes start off as features that the current system lacks. This leads you down to more detail requirements for the System (Level 2).

Level 2 Requirements – System Requirements: Much more specific requirements that help technical people with the design, coding, and testing of the system.
Drivers of requirements include: Performance, Interface, Software, Security, Operability, Regulatory, Security, Privacy, Personnel, Interface, Deployment, Maintainability, and Reliability.

A view from the top to the bottom in the requirements process might look something like:

Concept of Operations ► The user will have access to a project schedule
Functional Requirements ► The user will have the capability of updating the schedule every week on-line.
System Requirements ► The user will have the capability to modify the resources assigned to the schedule
Software Requirements ► The user will have the capability to add a name field to the schedule.

Your final requirements (Level 2 System or Software Requirements) will cover several areas, such as data storage requirements, system administration requirements, hardware requirements, and reporting requirements. The one area that usually drives up the cost of a new system will be reporting requirements. It's not unusual to see separate software add-on packages to address the myriad of reporting requirements that get defined.

In any event, let's walk through some actual examples of final requirements. Several of your requirements will speak to the capabilities of the system as it relates to how people interact with the system. Some examples include:

- *The System shall provide the user with the capability of selecting the project type.*
- *The System shall have the capability to allow authorized users to modify the project budget amounts.*

Some of your requirements may speak to how the system handles the data:

- *The System shall provide the capability of calculating an Estimate at Completion using the formula: Actual Costs + (Estimate to Complete / Cost Performance Index).*
- *The System shall provide the capability of calculating Indirect Labor Costs using the formula: Employee Direct Labor Cost * Fringe Benefits Rate*

A few requirements will speak to architecture, industry standards, and other requirements not related to the end-user:

- *The System shall provide the capability of importing an ASCII data file from the Financial Reporting Management System.*
- *The System Database shall be hosted on a server running Oracle 10g.*

Since requirements can take considerable time and effort to complete, software development projects sometimes compress the requirements effort by taking a Rapid Application Development (RAD) approach whereby you build a prototype model that works similar to the existing system. From the prototype you are able to flush out your requirements and move rapidly towards developing your new application.

Finally, here are some rules to follow with requirements:

1. Don't start writing requirements until you have an approved Concept of Operations; otherwise you run the risk of scope creep. A good ConOps will define the problem you are trying to solve (current state), how the system needs to work (future state), who will be using the system, and what architecture will be involved (hardware / software / protocol / interfaces).
2. Don't start designing anything until you have completed and baselined (customer approved) your requirements.
3. Track your requirements using Configuration Management. Use a Requirements Traceability Matrix to cross-reference your work between your Concept of Operations, Level 1 Functional Requirements, Level 2 System Requirements, and if necessary, Level 3 Detail Software Requirements.
4. Write requirements that are achievable – be realistic about what you can do to improve things. You have to be able to implement your requirements.
5. Make sure there is a real need for the requirement – what are the consequences of not including this as a requirement? It's also a good idea to prioritize your requirements since some things are must have vs. nice to have.
6. Requirements should be understandable by both technical and functional end-users.
7. Requirements should speak to what the system shall do. Most people avoid using the word "will" since this may impose a constraint.
8. Don't write negative requirements – all requirements must be positive statements to control testing. For example, "the system shall not allow" is a negative requirement that creates testing problems. It's also hard to validate minimums and maximums. So try to avoid these two words (minimum maximum) within your requirements.
9. Include a Conceptual Data Model showing the relationships between all of the data involved with your system. You can also include a Data Dictionary to describe each data element.

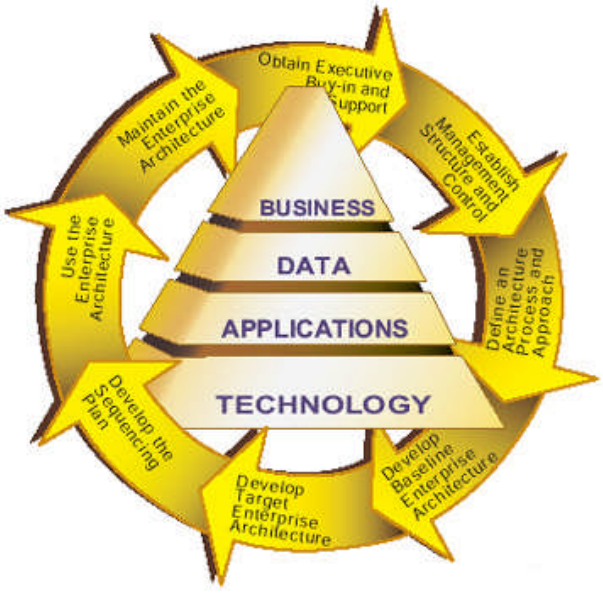
Enterprise Architecture

Most projects have an impact on either existing business processes and / or technology and most processes involve some form of information technology. Additionally, many organizations tend to have standard processes and specific types of applications and technologies behind these processes. In an effort to make the whole thing work without the introduction of new complications from projects, there is a need to express and follow a common Enterprise Architecture (EA).

The idea of “Enterprise Architecture” was pioneered by John Zachman (www.zifa.com) who argued that an organization must understand its information infrastructure and mange both the inter-relationships of various entities within this infrastructure (enterprise) and the underlying framework on which it operates (architecture). If an organization fails to enforce an EA, then the organization starts to disintegrate as managers, customers, and others impose change on systems, processes, and other components within the organization.

Enterprise Architecture (EA) is like putting together a jig-saw puzzle; you want to describe how major processes and technology fit and work together within the entire organization. EA represents the overall blueprint you want to follow, expressing the inter-operability of information, people, processes, infrastructure and other components that comprise the enterprise. In order to develop your EA, you will have to understand different business lines, services, processes, and architecture. For example, Business Architecture represents the business work flows across functions while various applications and their configurations are expressed within the Applications Architecture. Larger organizations tend to describe their EA through a collection of reference models with the combination of each forming the overall EA.

Developing Enterprise Architecture



Source: MITRE Corporation (www.mitre.org)

Change should be managed at the highest levels within a centralized framework and managed through an EA Program. There are several strategic reasons for developing and implementing an EA program:

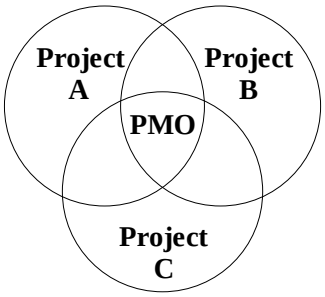
1. Alignment – You need to make sure management goals and objectives align to the processes and systems that are being developed or altered within the company.
2. Integration – Different processes and systems need to interface with one another. Inter-operability brings about certain efficiencies within the organization.

3. Standardization – Common or preferred ways of doing business need to be established and followed across the entire organization.
4. Implementation – The time, effort and resources invested in a process, system or other business component should be obtainable by adhering to a common framework defined by the EA.
5. Optimization – In an effort to optimize the overall business, you have to look at the complete EA picture.

> "The enterprise architecture is the organizing logic for business processes and IT infrastructure, reflecting the integration and standardization requirements of the company's operating model. The enterprise architecture provides a long-term view of a company's processes, systems, and technologies so that individual projects can build capabilities – not just fulfill immediate needs. Companies go through four stages in learning how to take an enterprise architecture approach to designing business processes: Business Silos, Standardized Technology, Optimized Core, and Business Modularity. As a company advances through the stages, its foundation for execution takes on increased strategic importance."
> – Enterprise Architecture as Strategy by Jeanne W. Ross, Peter Weill and David C. Robertson

Program Management Office (PMO)

Larger organizations will often have many initiatives or projects going on at the same time and many of these projects may overlap, dealing with inter-related issues. It is also useful to evaluate all projects collectively as a portfolio since invariably resources are limited, not to mention that priorities change over time. And finally, it is important to collect what works and cascade these best practices across the entire organization, creating a so-called Center of Excellence.



In order to pull all of this together, many organizations will form what is called a Project or Program Management Office or PMO. A PMO serves as a clearing house for enterprise wide project management practices, creating the infrastructure needed to support all projects throughout the company. This can create several benefits for the organization, such as:

- Establishing a standard set of practices and reports for evaluating project performance across the entire portfolio of projects.
- Organizing central communication on best practices between all of the projects.

- Developing common tools and applications that everyone can use for managing their projects.
- Reducing duplication and redundant activities between projects, thereby creating additional efficiencies.
- Fostering a culture of project management throughout the organization.
- Assessing the viability and effectiveness of different projects and programs in meeting enterprise-wide goals.

Forming a PMO will require highly skilled people with strong backgrounds in project management since the PMO must communicate and train others in best practices. The PMO must also have the authority to govern and act on implementing project management practices. Therefore, the PMO will need strong sponsorship and support from executive management. One way to signify some authority behind a PMO is to place the PMO high-up in the organizational structure, such as an extension of the Chief Information Officer.

> "In essence, enterprise project management isn't all that different from basic project management. It varies sharply, however, in the way it is applied and the emphasis that is given to each area of expertise. Whereas basic project management is aimed largely at answering 'How can we get this project done effectively and efficiently' enterprise project management poses the question, 'How can we make this business more adaptive, responsive, and thus more profitable in a rapidly changing, multi-project environment.' The two concepts are highly complementary, and work together to boost company productivity and effectiveness."
>
> – Winning in Business with Enterprise Project Management by Paul C. Dinsmore

Project Level Maturity

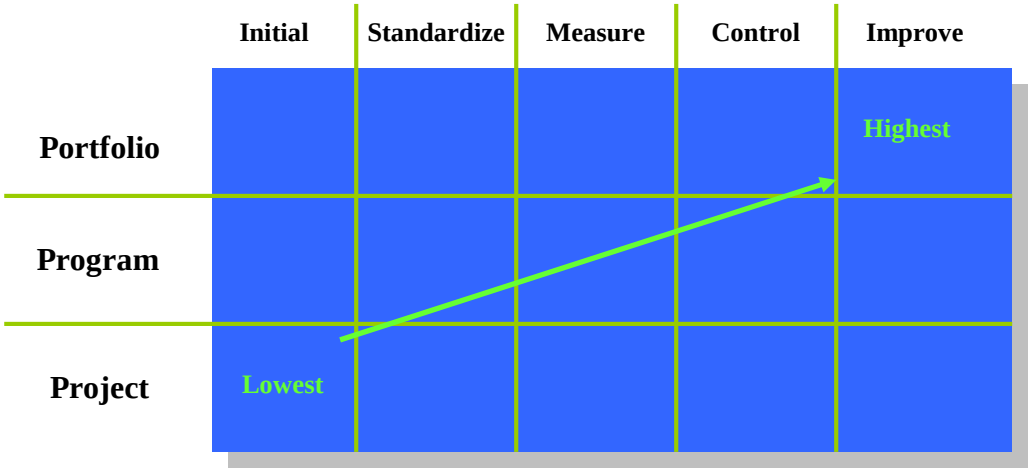
For organizations that operate around projects, it might be useful to measure the level of project management maturity within the entire enterprise. It's somewhat similar to how software development gets assessed under the Capability Maturity Model (CMM). If we follow this same approach (CMM) and combine it with the body of knowledge developed by the Project Management Institute (PMI), then we can follow the Organizational Project Management Maturity Model or OPM3 (http://opm3online.pmi.org).

The OPM3 Model views maturity horizontally from project management to program management to portfolio management and vertically in terms of the different maturity levels (Initial ► Standardize ► Measure ► Control ► Improve).

Programs – Major initiatives that must be subdivided into several projects, such as an enterprise wide initiative. Similar to a project, programs have overall goals and objectives.

Portfolio – Process for selecting, evaluating, and investing in projects in such a way that the highest strategic impact is obtained for the best return on investment.

The 3P's (Projects, Programs, Portfolio) represent the three dimensions of organizational project management. This can be depicted across the five maturity levels, showing the lowest level of maturity to the highest level of maturity:



Although it's easy to label what project maturity looks like, it's a lot more useful to identify the underlying drivers behind maturity. For example, in his book Project Management - A Systems Approach to Planning, Scheduling and Controlling, Harold Kerzner, Ph.D. describes sixteen points to achieving project maturity:

1. Adopt a project management methodology and use it consistently.
2. Implement a philosophy that drives the company toward project management maturity and communicate to everyone.
3. Commit to developing effective plans at the beginning of each project.
4. Minimize scope changes by committing to realistic objectives.
5. Recognize that cost and schedule management are inseparable.
6. Select the right person as project manager.
7. Provide executives with project sponsor information, not project management information.
8. Strengthen involvement and support of line management.
9. Focus on deliverable rather than resources.
10. Cultivate effective communication, cooperation, and trust to achieve rapid project management maturity.
11. Share recognition for project success with the entire project team and line management.
12. Eliminate non-productive meetings.
13. Focus on identifying and solving problems early, quickly, and cost effectively.
14. Measure progress periodically.
15. Use project management software as a tool - not as a substitute for effective planning or interpersonal skills.
16. Institute an all-employee training program with periodic updates based upon documented lessons learned.

Another example of project maturity is to look at what constitutes project success. In the book, The Complete Idiot's Guide to Project Management, authors Sunny Baker, Kim Baker, and G. Michael Campbell describe the twelve golden rules to project success:

1. Gain consensus on project outcomes
2. Build the best team you can
3. Develop a comprehensive plan and keep it up to date
4. Determine your resource needs, such as staffing and facilities
5. Have a realistic schedule
6. Don't try to do too much (stay within scope)
7. People make the difference (critical element)
8. Gain support of management and stakeholders for the project
9. Be willing to change as you work through the project
10. Keep everyone informed – communicate!
11. Be willing to try new things – innovate!
12. Lead – projects require strong leadership

It is these intangibles that bring about a high level of maturity to the project management environment.

> "We define project management as the allocation, tracking, and utilization of resources to achieve a particular objective within a specified period of time."
> – The Essentials of Project Management by Harvard Business School Press

Course Summary

Projects have become a main-stay of how organizations deal with critical issues. So it invariably stands to reason that everyone needs to understand how to manage projects. And fortunately, there is a well established body of knowledge, widely accepted and practiced consisting of things like:

- Organizing and controlling your project work through things like a Work Breakdown Structure, Organizational Breakdown Structure and Control Accounts.
- Integrating your schedule and budget into a baseline by which performance can be measured.
- Defining project deliverables and milestones for evaluating your progress.

At the heart of project management is project planning. Project plans need to include:

1. Mission, Purpose and Goals
2. Work Breakdown Structure, describing the work that must get done
3. Work Schedule in terms of a time frame
4. Detail Budget covering all expected costs to be incurred
5. Quality Control process
6. Risk Management process
7. Change control process

Additionally, we can point to numerous project artifacts or outputs that get us through the project life cycle:

- **Project Initiation** ► Start with a concept of what the project is expected to do, make your complete business case for doing the project, and kick your project off by having senior leadership sign off on a Project Charter.
- **Project Planning** ► Develop a project schedule and budget, assign resources to load the schedule, identify specific work products and finalize everything into a Performance Measurement Baseline.
- **Project Execution** ► Follow your plan and deliver various work products required as described in the Project Management Plan. For example, a typical software development project will involve specific deliverables such as: User Requirements, Risk Analysis, System Requirements Analysis, Software Requirements, Preliminary System Design, Software Design, Software Test Plan, Software Development, Database Development, Software Testing, Software Integration, Formal Testing, Deployment Plan, and User Training.
- **Project Control** ► Manage all of the changes taking place, including various risk that have been identified in your Risk Management Plan.
- **Project Close-Out** ► Since projects are not permanent, you need to follow a close-out process, such as signing off on final deliverables, summarizing what went well and what mistakes were made, and making sure all administrative matters are closed-out.

In conclusion, there are many reasons for doing projects. Things that are new to an organization tend to lend themselves to projects. However, there are other fundamental

reasons for doing projects – cross fertilization of knowledge and skills, leveraging critical talent, and giving senior management an independent reality check regarding a solution to a critical problem. Regardless, projects are now the pathway for how organizations improve their business results in a fast changing world.

> "The high-impact project is the gem . . the nugget . . the fundamental atomic particle from which the new white collar world will be constructed and / or reconstructed."
> – Reinventing Work: The Project 50 by Tom Peters

Review Questions

1. Project Management consists of nine management areas that collectively form the discipline of project management. Most professionals simply refer to this knowledge as:
    a. SWOT
    b. PMBOK
    c. DART
    d. PAMP

2. Project planning culminates through the integration of scheduling, costs, and other planning components to form the:
    a. Project Charter
    b. Design Document
    c. Risk Response Schedule
    d. Performance Measurement Baseline

3. Which of the following is an example of a quality control practice?
    a. Updating the project schedule
    b. Shifting resource allocations
    c. Revising the project budget
    d. Testing the application

4. Which of the following is an example of a communication medium within a communication plan?
    a. Changes to the Baseline
    b. Minutes of Meetings
    c. Deletions to the WBS Structure
    d. Activity Durations

5. A project risk represents any event that could potentially impact a project's:
    a. Work products, resources or budget.
    b. Quality, costs, schedule or scope.
    c. Sponsorship, resources or life cycle.
    d. Funding, schedule or longevity.

6. Which of the following is an example of a risk response?
    a. Mitigation
    b. Removal
    c. Termination
    d. Suspension

7. A project activity has an Early Start Date on Day 12, an Early Finish Date on Day 17, a Late Start Date on Day 16 and a Late Finish Date on Day 21. The float time for this activity is:
    a. 6 days
    b. 4 days
    c. 7 days
    d. 3 days

8. Projects usually create specific work products or deliverables. These outputs signify progress during the life cycle of a project. Which of the following work products are most likely associated with the respective life cycle phases of the project:

	< - - - - - - - - - Project Life Cycle Phases - - - - - - - - - ->		
	Initiation	Planning	Execution
a.	Project Schedule	Project Charter	Close Out List
b.	Business Case	Network Diagram	Progress Report
c.	Network Diagram	Status Report	Transfer Template
d.	Concept Paper	Close Out List	Project Charter

Questions 9 and 10 relate to the following Earned Value Management Report:

Cost Variance . . . . . $ 16,000
Schedule Variance . . . . . $ - 8,000
Estimate at Completion . . . . . $ 676,500
Budget at Completion . . . . . $ 650,000

9. If Earned Value is $ 110,000, then Planned Value must be:
    a. $ 108,000
    b. $ 94,000
    c. $ 118,000
    d. $ 112,000

10. The Variance at Completion is:
    a. $ 26,500 unfavorable
    b. $ 24,000 unfavorable
    c. $ 17,500 favorable
    d. $ 32,500 favorable

11. The System Development Life Cycle (SDLC) consists of five different phases which follow in a certain sequence. The order in which each phase occurs is:

	1st	2nd	3rd	4th	5th
a.	Design	Develop	Test	Requirements	Implement
b.	Develop	Test	Design	Implement	Requirements
c.	Requirements	Design	Develop	Test	Implement
d.	Design	Test	Implement	Develop	Requirements

12. The initial deliverable associated with requirements analysis is the:
    a. Traceability Matrix
    b. Conceptual Data Model
    c. Preliminary Design
    d. Concept of Operations

13. Before you can write detail requirements that are useful for technical personnel, you may have to first identify:
    a. Functional Requirements
    b. Software Requirements
    c. Negative Requirements
    d. Transparent Requirements

14. Which of the following reasons would directly support the development and implementation of an Enterprise Architecture Program:
    a. Spread out scheduling risks
    b. Enhance inter-operability
    c. Enable global communications
    d. Reduce transfer costs

15. Organizational maturity of project management practices is advanced when the organization is managing at the:
    a. Business Unit Level
    b. Department Level
    c. Portfolio Level
    d. Project Level

Appendix A - Recommend Reading

1. The McGraw Hill 36-Hour Course on Project Management by Helen S. Cooke and Karen Tate
2. The Everything Project Management Book by Rich Mintzer
3. A Survival Guide for Project Managers by James Taylor
4. The Project Management Tool Kit by Tom Kendrick
5. Harvard Business Review on Managing Projects
6. The Essentials of Project Management by Harvard Business School Press
7. Facilitating the Project Life Cycle by Jan Means and Tammy Adams
8. Project Management DeMystified: A Self Teaching Guide by Sid Kemp, PMP
9. Alpha Teach Yourself Project Management in 24 Hours by Nancy Mingus
10. Project Management for Dummies by Stanley E. Portny
11. The Project Managers' Desk Reference by James P. Lewis
12. Fundamentals of Project Management by James P. Lewis
13. The Little Black Book of Project Management by Michael C. Thomsett
14. Getting Started in Project Management by Paula Martin and Karen Tate
15. Brief Case Books – Project Management by Gary R. Heerkens
16. The Complete Idiot's Guide to Project Management by Sunny and Kim Baker and G. Michael Campbell
17. Absolute Beginner's Guide to Project Management by Gregory M. Horine
18. Successful Project Managers: Leading Your Team to Success by Jeffrey K. Pinto and O. P. Kharanda
19. The Art of Project Management by Scott Berkun
20. A Guide to the Project Management Body of Knowledge by Project Management Institute
21. The AMA Handbook of Project Management by Paul C. Dinsmore and Jeannette Cabanis-Brewin
22. Project Management Jump Start by Kim Heldman, PMP
23. Human Resource Skills for the Project Manager by Vijay Verma

Appendix B - Terminology

Activity: A specific component of work that collectively with other activities forms a level of work defined in the Work Breakdown Structure. Activities tend to be of very short duration, such as a few weeks. Activities often represent work packages.

Baseline: A snap shot at a given point in time of how you expect to execute the project. The full integration of time phased budgets, schedules, and other components results in the Performance Measurement Baseline.

Business Case: A formal document that fully describes the problem, its impact, and different alternatives for addressing the problem. The business case also includes an economic analysis of different alternatives, showing the Net Present Value and Return on Investment for each alternative.

Change Control: Establishing and following a set of control procedures to manage changes in how you manage the project. This can include changes to the project schedule or budget. It can also include changes to project work products, such as approving a change to the design.

Concept Paper: An initial rough description of what the project is about and how it will bring about needed change within the organization. Concept Papers are very brief - only a few pages in length.

Configuration Management: A centralized structure and process for managing changes so that everything is properly integrated across all components that get impacted by the change.

Control Account: The lowest level where management control is necessary, usually found by looking at the lowest intersection point between the WBS and OBS.

Cost Variance: Earned Value less Actual Costs as of a certain cutoff date for evaluating project performance. A positive variance is considered favorable, implying that work has been completed in excess of the related actual costs incurred.

Critical Path Method: A method used in scheduling that identifies the path of activities with no float times based on early start dates, early completion dates, late start dates, and late completion dates.

Deliverable: A final result of project work delivered to the customer.

Earned Value Management: A set of practices that measures project performance using three parameters: Planned Value, Earned Value, and Actual Costs.

Enterprise Architecture: The articulation of various systems and processes within an organization and how they fit together. This common framework helps ensure that business goals and objectives are met when changes are made to various business components, such as the processes or the information take place.

Estimate at Completion: The total expected costs of completing the project.

Estimate to Complete: As of a certain cutoff date, the remaining total costs to complete the project.

Float Time: Additional time available for an activity without creating delays to the project.

Functional Requirements: Descriptive requirements from users on how they want the system to work.

IV & V: Independent Verification and Validation (IV&V) of project work products and processes to ensure the project is meeting its objectives and goals.

Life Cycle: The entire time period associated with the project, usually consisting of five phases, starting with project initiation. The next four phases are: planning, execution, control, and close-out.

Milestone: An end point that signifies progress during the project, such as completion of the requirements phase of the project.

Organizational Breakdown Structure (OBS): A framework for identifying who will do the project work from a high organizational level down to the roles or functional titles of different personnel. The OBS covers all organizational elements, including outside contractors, to account for all resources behind the project.

Organizational Project Management: An enterprise wide view of project management practices that usually covers three dimensions: Projects, Programs, and the Portfolio management of all projects and programs.

Performance Measurement Baseline: The current plan for executing the project, expressed in terms of different dimensions, such as the project schedule, the project budget, WBS elements, and other important components. When fully integrated together, these components form the Performance Measurement Baseline.

Program: A group of projects that to some extent are managed collectively to ensure optimal management of resources, processes, and other practices important to the organization.

Program Management Office: An enterprise wide central function that provides governance and oversight over a portfolio of projects.

Project: A temporary undertaking required to address an organizational issue as opposed to recurring operational type work.

Project Charter: A document describing and authorizing a project to commence with actual work.

Project Management Plan: A formal document that fully describes how the project work will get done. Several specific plans are included in the PMP – Project Schedule, Quality Control Plan, and Risk Management Plan.

Project Schedule: The division of project work into time phases and sequences based on expected start and completion dates as well as inter-relationships between the work.

Project Scope: A description of all work that must be accomplished by the project, usually best defined in terms of tangible work products, deliverables, and milestones.

Quality Management: The process of making sure that all project work products are acceptable.

Schedule Variance: Earned Value less Planned Value as of a certain cutoff date for evaluating project performance. A positive variance is considered favorable, implying that work has been completed in excess of what was planned.

Responsibility Assignment Matrix: A matrix type template that summarizes the responsibilities for project work in relation to the WBS.

Risk Event: A possible event that may occur in the future; involving a wide range of possibilities, such as changes to scope, technical obsolescence, reliability of systems, organizational changes, security breaches, cost over-runs, and lack of support for the project.

Risk Impact: The effect a risk event has on the project, usually in terms of changing the scope, schedule, resources, or quality of the project.

Risk Management: The process of identifying, measuring, and controlling risk. This information is documented in the Risk Management Plan.

Risk Response: Planned actions that are taken for those risk events included in the risk management plan, such as specific steps to reduce or eliminate a threat.

Rolling Wave: An iterative approach to project planning and execution that provides more flexibility since detail schedules are only required for near term work, such as six months or one year. Long-term work is held open in summary level planning packages.

Scope: The primary purpose and objective of the project, including all work that must be accomplished to declare the project as complete.

SME: Subject Matter Expert – someone who possesses a lot of expertise in a specific subject area.

System Requirements – Very detail requirements that technical people can design, code and test against in building the system.

Triple Constraint: The three main constraints common to how you manage projects consisting of scope, time, and cost or resources. When one of the constraints changes, such as scope, this usually impacts the other constraints.

Work Breakdown Structure (WBS): A breakdown of all project work into a logical hierarchy consisting of different levels. Each lower level provides more detail describing the work.

Work Package: A small unit of work, such as a collection of tasks or steps, usually accomplished in a relatively short period of time (such as two to three weeks). Work packages are often expressed as Activities in a project schedules, plans, and other documents.

Final Exam

In order to receive credit for this short course, you must correctly answer at least 7 of the following 10 questions correctly. You can take this exam on-line by clicking on the "take exam" hyperlink located over the internet at www.exinfm.com/training. If you want a Certificate of Completion for taking this course, then you must download and use the "exe" file version of this short course.

1. Which of the following documents officially kicks a project off and gets it started:

    a. Change Control Forms
    b. Project Charter
    c. Concept Paper
    d. Design Document

2. The project life cycle begins with *Initiation* followed by:

    a. Submission
    b. Control
    c. Approval
    d. Planning

3. The scope of project work is broken down and defined through the use of a:

    a. Work Breakdown Structure
    b. Risk Management Profile
    c. Requirements Traceability Matrix
    d. Quality Control Plan

4. The level where project management control is needed is often represented by the lowest intersection between the WBS and OBS. This information can be captured and documented on a template known as the:

    a. PERT Template
    b. Change Control Log
    c. Responsibility Assignment Matrix
    d. Cross Fork Diagram

5. Project managers usually manage a project within three primary constraints. These three constraints are:

    a. Budget, Resources, and Risks
    b. Scope, Time, and Costs
    c. Schedule, Resources, and Risks
    d. Scope, Risks, and Sponsorship

6. For purposes of measuring and reporting project performance, the amount of work actually completed can be expressed in terms of:

    a. Resource Value
    b. Project Value
    c. Earned Value
    d. Planned Value

7. The following performance information has been compiled for the most recent reporting period:

    Actual Costs to Date . . $ 130,000
    Planned Value to Date .$ 160,000
    Earned Value to Date . .$ 120,000

    Based on these three performance parameters, the Schedule Performance Index is:

    a. .75
    b. .84
    c. .92
    d. 1.33

8. In an effort to control costs associated with the Systems Development Life Cycle, projects will manage one phase until completion before starting the next phase. This approach is typically referred to as the:

    a. Spiral
    b. Incremental
    c. Rolling Wave
    d. Waterfall

9. One of the biggest challenges in writing system requirements is – How much detail to include? Most people follow the DCT Rule which simply says you should write requirements down to a level that you can:

    a. Develop, Compare and Train to
    b. Design, Code and Test to
    c. Discover, Compress and Tally to
    d. Determine, Cascade, and Turnover

10. John Zachman pioneered a concept of understanding how business processes, functions, systems, and other components interact and fit within different types of infrastructures (such as information assets). This concept is practiced through the development and management of:

    a. Baseline Management
    b. Resource Requirements Analysis
    c. Enterprise Architecture
    d. Life Cycle Maintenance

Answers to Review Questions

1. b	6. a	11. c
2. d	7. b	12. d
3. d	8. b	13. a
4. b	9. c	14. b
5. b	10. a	15. c